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Designing Playful Systems

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UNIVERSITY OF PLYMOUTH

Designing Playful Systems

by

Michael Straeubig

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in partial fulfilment for the degree of

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Author's declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Doctoral College Quality Sub-Committee.

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A handwritten signature in black ink, consisting of a stylized 'M' followed by a cursive flourish, written over a horizontal line.

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Abstract

Play is a common, yet elusive phenomenon. Many definitions of play and explanations for its existence have been brought forward in various disciplines such as psychology, anthropology, ethology and in the humanities. As an activity apparently serving no other purpose than itself, play can be simply considered a pleasant pastime. Yet its equation with fun has been challenged by artists and scholars alike. Being in a playful state does not warrant extrinsic motivation or being conscious of an external purpose. However, play creates meaning, and scientists are pursuing functional explanations for it. These conflicting observations are contributing to the ambiguity of play and they raise questions about the limits of the complexity that present discourses are able to reflect.

This thesis presents a comprehensive, transdisciplinary approach to describe and understand play, based on systems-theory, constructivism, cybernetics and practical exploration. Observing play in this way involves theoretical analysis, reflection and critique as well as the practice of design, development and artistic exposition. By constructing, re-contextualising and discussing eight of my own projects, I explore the distinction between theory and practice through which playful systems emerge.

Central to my methodology is the concept of distinctions as a fundamental method of observation. It is introduced itself as a distinction and then applied throughout this thesis, in order to describe and discuss phenomena of play from a wide range of different perspectives. This includes paradoxical, first-person and conflicting accounts and it enables discourses that cross disciplinary boundaries.

In summary, the three interrelated contributions to knowledge in my research project are: I contribute to the emerging field of game studies through a comprehensive systems-theoretical description on play. I also provide a methodology in which theory and practice inform each other through mutual observation, construction, reflection and critical evaluation. Finally, I present eight projects, including a playful system developed in a speculative approach that I call anthroponeutral design. These results represent a novel transdisciplinary perspective on play that offers new opportunities for further research.

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Introduction

[...] so what the hell is play, anyway?

Scott G. Eberle (2014)

The Cold War

My adolescence took place during the fading stretch of the Cold War. While I was heading to school each morning, I felt the scenario of a nuclear conflict towering over me. Then came AIDS, the fall of the Berlin Wall, Chernobyl, and then apparently the end of history (Fukuyama 2012). As a teenager during this time, I had many problems, among them a very particular one. As much as I tried, I could not picture myself as an adult.

While some of my classmates were already planning careers, families and homes, my mind was constantly drawing blanks. Despite daydreaming a lot, I could not figure out the idea of adulthood which I pinned to the age of 34. My main difficulty was to image myself doing what grown ups supposedly are doing during the week, which is going to work to earn a living. My high school education was suggesting a future where my days would be spent in some kind of office, working for someone, having holidays and weekends off. All this I was not able to imagine at all. No stretch of my otherwise limitless imagination did the trick.

In retrospect, this is a question that still puzzles me. In the meantime I have spent time in offices and I have worked as an employee, while avoiding both of those situations as much as possible. I have had different strategies for this such as studying longer than expected, working part time, becoming self-employed or doing a PhD. But perhaps the most significant aspect of this journey is that I have been professionally concerned with play during the last 15 years of my career.

Play has been described through its opposition to work (see Play vs. Work (p. 51)), yet the

relationship is much more complicated, as the following chapters will reveal in detail. I have been exploring games and play through my work as game designer, researcher, lecturer and consultant. While I was creating and researching games and playful experiences, I was working with play and I was also playing while I worked.

My PhD project and the resulting thesis are expressions of my desire to understand play and work at a fundamental level. This understanding must remain incomplete — it keeps emerging by theoretical examination, through discourse and with practice. This thesis represents a snapshot at a particular point in time. I hope that it will be useful for the wider academic community to continue the journey.

Research Context

Both work and play are ubiquitous phenomena without a specific academic homestead. Various disciplines such as psychology, anthropology, ethology, pedagogy and the humanities have produced theories to explain or to describe play. Work is studied within the field of human factors and ergonomics and in the wider context of economic theories.

As I will discuss in the following chapters, the existing efforts have resulted in inconsistent and incommensurable accounts about play. This “ambiguity of play” was famously acknowledged by Brian Sutton-Smith (1997), but so far his diagnosis is still in search of solutions. Although we engage in play from early childhood onwards, we face difficulties when we try to analyse and understand it. The current methodological and ideological rifts between the various academic and practical disciplines are too wide.

Any theory capable of describing a multi-faceted phenomenon such as play cannot be bound to the perspectives and problems of one specific field. Yet it cannot ignore the contributions of the established disciplines. Game studies, an interdisciplinary field that has emerged from media studies during the last two decades, has tacitly embraced play as a fully-fledged subject of research (Mäyrä, Lammes, et al. 2015; Mäyrä, Arjoranta, et al. 2016).

The context of my work, published during the course of this project (see Published Work (p. 9)), suggests that this thesis can be located within the game studies (Järvinen 2008) (see also Play and Discipline(s) (p. 151)). There is a caveat, however, and this is connected with the history of this new discipline. From its inception, an almost exclusive focus on games

as media artefacts rather than as media for play has been delaying the development of game studies as a field. This has resulted in long-standing disputes, particularly in the narratology vs. ludology debate (Frasca 1999). I believe that the observation of games and play from a systems-theoretic perspective provides some reason for hope that these debates are a matter of the past and that the field can move on (compare Ludus vs. Narratio (p. 85) and A Third Culture? (p. 149)).

First of all I argue that any viable approach for describing play in a comprehensive manner has to be transdisciplinary (Blassnigg and Punt 2013). This means, it has to be capable of describing and transcending established disciplines. In other words, it must be able to observe observers. To achieve this, the underlying theory has to be sufficiently abstract, complex, and universal. This rules out mono-thematic approaches, say, describing play from a child development perspective (Martin and Caro 1985) or theories that operates on purely biological (Burghardt 2005b) or ideological levels (Nash and Penney 2015).

Those necessary qualities, I claim, can be found in specific areas of general systems theory, especially through a critical appreciation of the work of Niklas Luhmann (1996). A systems-theoretic perspective does not claim a privileged relation to truth — it is a particular perspective. However, as I will set out in the next chapter, it is capable of observing play in its many possible meanings and facets. It can deal with contradictory, self-referential and paradoxical descriptions (see Paradoxa of Play (p. 69)). According to Luhmann, to succeed in a systems-theoretic interpretation, it has to provide adequate *Anschlussfähigkeit*, options for continuing the discourse about games and play within the academic community and beyond (see Requirements for a New Paradigm (p. 24)).

Research Questions

I pursue three related questions in this thesis.

Fundamentally, I aim to answer the question “what is play?” from a systems-theoretic perspective by describing and designing playful systems. I contend that a distinctions-based approach based on radical constructivism and systems theory as a method of investigation adds to our current understanding of play.

Secondly, I ask, how can the interplay between theoretical and practical work inform each other towards such an understanding? How does practice inform theory and how does

theory inform practice? How are playful systems designed? Which directions can their design take and what are the requirements to provide a comprehensive description of them?

I also have been considering the speculative research question “can machines play?” as a vehicle to drive my research and practice.

Methodology

The research context of this thesis is rooted in methods that I locate in the realm of art practice and the humanities: artistic research, prototyping, speculative and experimental game design, literature review, phenomenology, philosophical analysis, critical reflection and exposition of practice (Schwab and Borgdorff 2014). My adoption of empirical and engineering disciplines such as artificial intelligence is based on Michael Mateas’ idea of expressive AI. Mateas describes it as “a new interdisciplinary of AI-based cultural production combining art practice and AI research practice” (Mateas 2001). I diverge from Mateas however, regarding his emphasis on artistic success governed by audience response (see Mateas and Schwab: Artistic Research (p. 38)).

In particular, my work is not empirical in the sense of (social) sciences (compare Play and Discipline(s) (p. 151)) nor intended to create artefacts for external, commercial purposes (and I would include artistic success in this category). Rather, I conceive the games and playful experiences I have created as artistic laboratories where design, preparation, exposition and reflection constructs, observes and questions knowledge.

This includes a project like *neurotic*, my rather unsuccessful attempt to capture certain characteristics of a biological system (see Project: Neurotic (p. 100)). It is among the projects I describe in this thesis, because its research character has revealed *Anschlussfähigkeit* in the system-theoretic sense, opportunities to continue (see Research Context (p. 2) and Requirements for a New Paradigm (p. 24)).

KlingKlangKlong, on the other hand, is explicitly designed to be indifferent towards the question of whether its players are humans or algorithms¹ (see Project: KlingKlangKlong (p. 110)). The distinction between human and machine is crossed deliberately and playfully. The other projects adhere to the same principle: they interrogate distinctions by crossing

¹The discussion in which sense a machine can or cannot play is covered extensively in chapter Human vs. Machine (p. 97).

their respective boundaries.

Spiel 1 explores the space created by the distinctions serious vs. playful and fictional vs. real (see Project: *Spiel 1* (p. 57)) while *Non-Sense of Place* (see Project: *Non-Sense of Place* (p. 130)) explores different system vs. environment distinctions. *Hostile Environment Facility Training* (see Project: *Hostile Environment Facility Training* (p. 40)) deals with the theme of difference and distinction itself, distinction vs. identity. These experiments and projects are constructions at the intersection of playful experiences, constructivism and systems theory.

In the iterative process of theory-construction, design, implementation and critical evaluation, my projects began to inform my theoretical work while the theory informed my projects. The shift from human players to anthroponeutral design in *KlingKlangKlong* is representative for these processes of updating, refining and questioning in the design of playful systems (see Discussion (p. 114) and Anthroponeutral Design (p. 157)). Publications, conferences, my secondment, and continuous practice (see Published Work (p. 9)) became artistic observatories using the lens of distinctions.

Contribution to Knowledge

In this thesis, I aim to contribute to the studies of games and play with regard to three aspects:

The primary contribution is to present a comprehensive systems-theoretic description of play. My approach builds upon constructivist and second-order cybernetic foundations, in particular Spencer-Brown's calculus of distinctions and Maturana and Varela's autopoiesis (see Distinction vs. Identity (p. 15)). I will apply a specific system-theoretic approach to a wide range of phenomena of play, derived from the theory of social systems by Niklas (Luhmann 1996). Based on my reading of current literature, as of today this approach is original and has not been considered before in this scope (compare Related Work (p. 13)). Luhmann's method of describing systems is based on distinctions, not identities, which allows multiple entry points into the theory, e.g. system vs. environment, medium vs. form or operation vs. observation (Baraldi, Corsi, and Esposito 1997).

While my approach to describe play (see Play vs. Non-Play (p. 49)) largely draws from Luhmann's work, it does depart from it in significant ways. Whereas Luhmann excluded

machines from participating in social systems, I believe that both technological and social developments warrant a re-examination of this exclusion (see Human vs. Machine (p. 97)). More fundamentally, my treatment of play does not focus on social systems but on a general distinction-based and systems-theoretic perspective.

My second contribution is the construction of a bridge between this theory and the practice of game and play design. Its starting point is following the speculative question “Can machines play?”, which echoes Alan Turing’s question “Can machines think?” (Turing 1951). Machines, including mechanical entities, robots and computer programs, presumably do not have an intrinsic concept of play. Yet we accept artificial and virtual entities as play objects and partners. This raises the question: in which sense can a machine play?

Furthermore, how does one design playful interactions not only with a machine but for machines and humans alike – a speculative approach that I call anthroponeutral design (see Anthroponeutral Design)? I critically examine previous attempts at modelling play and propose a number of directions for designing playful systems, relocating established system boundaries between machines, games and humans.

The third contribution is the demonstration of my practice. To this end, I present several projects that play with systems-theoretic distinctions. These projects are the mobile multiplayer experiences *KlingKlangKlong* (see Project: KlingKlangKlong (p. 110)) and *neurotic* (see Project: Neurotic (p. 100)), the performance *Spiel 1* (see Project: Spiel 1 (p. 57)), the *Imperfect VR* workshops (see Project: Imperfect VR (p. 74)), the exhibition *Non-Sense of Place* (see Project: Non-Sense of Place (p. 130)) composed of three projects *Pedestrian Fitness Initiative for Plymouth* (see Project: Pedestrian Fitness Initiative for Plymouth (p. 135)), *CO2rnwall CO2 Challenge* (see Project: CO2rnwall CO2 Challenge (p. 130)) and *Speed Gardening Guerrilla* (see Project: Speed Gardening Guerrilla (p. 138)) and the interactive installation *Hostile Environment Facility Training* (see Project: Hostile Environment Facility Training (p. 40)). Except for my two earlier games *Spiel 1* and *Speed Gardening Guerrilla*, I designed and developed these projects during my PhD

project beginning in April 2014.

Structure of the Thesis

The title of this thesis is “Designing Playful Systems” but it will be necessary to visit these three concepts in reversed order: initially “System”, then “Play”, and finally “Design”. This is because the latter concepts build on a theoretical understanding of the former. Therefore, I begin with a discussion of distinctions and subsequently move towards systems, play, virtuality, machines and finally to the distinction between theory and practice. Distinctions themselves will be introduced as a distinction, namely the one between distinction and identity. This approach diverges from the usual manner of demarcating the boundaries of a topic via definitions found in the literature. Definitions will re-appear as observations on a dynamic map, not as rulers of entrenched conceptual territories.

My practice, on the other hand, originates from the design and construction of systems that exhibit playfulness. Creating games and playful experiences has a long cultural tradition and a wealth of design methods is available in the literature. This established body of knowledge presupposes a design that targets human players. I have critically questioned established design concepts throughout my project and propose a set of directions for designing playful systems in the final chapter.

These conceptual structures result in movements in both directions, where practical experiments juxtapose the theoretical strands of the thesis. The nature of printed text makes it necessary to linearise one’s thoughts whereas a hypertext would have been more appropriate. I aim to remedy the exposure for the reader by alternating sections where I observe my own practice with the theoretical parts within each chapter.

For each of my constructions, I provide a description of the project, its development process and its history of exposition. Finally, I discuss and evaluate the contribution of each project for this thesis. To aid the navigation, I frequently include cross-references between sections that should be most useful in the electronic version of the thesis.

The individual chapters are organised as follows:

Chapter 1, *Distinction vs. Identity*, introduces the theoretical and practical basis for my distinction-based approach. Section Project: Hostile Environment Facility Training (p. 40) illustrates the fundamental distinction while the rest of the chapter covers relevant

background in systems theory, second-order cybernetics and radical constructivism as well as in practice-based approaches. The chapter also aims to clarify differences to related theories such as social constructionism.

Chapter 2, *Play vs. Non-Play*, contains a description of play from a systems-theoretic perspective. I observe play through the lens of distinctions such as play vs. work and I navigate through a series of them to make sense of the ambiguous and paradoxical nature of play. *Spiel 1* (see Project: *Spiel 1* (p. 57)) plays with the concept of serious games and with the distinction between play and purpose. Two further aspects of play that have evolved during my project are treated in more detail in the following chapters.

Chapter 3, *Virtual vs. Real*, discusses aspects related to play that deal with the concept of reality. This concerns distinctions between fiction, reality, potentiality and virtuality and also involves the distinction between medium and form. The *Imperfect VR* workshop series (see Project: *Imperfect VR* (p. 74)) discusses questions about virtual reality in a practical manner.

Chapter 4, *Human vs. Machine*, lays the ground for the conceptual bridge between theory and practice. It takes its origin from Alan Turing's question "can machines think?" and poses the speculative research question "can machines play?". This chapter is the most speculative in the sense that it locates playfulness outside the established realms of play and games. I discuss two projects, *neurotic* (see Project: *Neurotic* (p. 100)) and *KlingKlangKlong* (see Project: *KlingKlangKlong* (p. 110)) as examples for the design of playful systems.

Chapter 5, *System vs. Environment*, shifts the focus of observation from the phenomenon of a playful system to its environment. It also contains *Non-Sense of Place*, an exhibition of three of my projects addressing the distinction between system and environment: *CO2rwall CO2 Challenge*, *Pedestrian Fitness Initiative for Plymouth* and *Speed Gardening Guerrilla* (see Project: *Non-Sense of Place* (p. 130)).

Chapter 6, *Theory vs. Practice*, visits the notion of academic disciplines and highlights developments in experimental game and play design and related artistic and scientific areas. Here I summarise the concept of designing playful systems as research and provide

directions for future research and practice.

Published Work

I have published ideas in various stages of development in the course of my doctoral project, in the form of articles and presentations at conferences. These publications are complemented by exhibitions of my practice that I developed or re-contextualised for my PhD.

“On the distinction between distinction and division”, published in *Technoetic Arts* (Straeubig 2015c), introduces the distinction-based reasoning discussed in chapter *Distinction vs. Identity* (p. 15). A specific application of this method to epistemological questions concerning video games is the topic of my talk *Do Playful Systems Know That They Play* presented in 2016 at the Philosophy of Computer Games conference in Malta (Straeubig 2016c).

Some thoughts about the distinction between games and art, addressed in section *Games vs. Art* (p. 63) are reflected in my review of Brian Schrank’s *Avant-Garde Videogames: Playing with Technoculture*, that appeared in *Leonardo Reviews Online*, September 2014 (Straeubig 2014a). An update of my thinking about the art system in the context of developments in artificial intelligence and machine learning is contained in the short paper *Do Machines Produce Art? No. (A Systems-Theoretic Answer)*. I presented my views on this topic at ISCMA 2019 in Hong Kong (Straeubig 2019).

Some of my research into the distinction between virtual and real, described in chapter *Virtual vs. Real* (p. 73), is based on my talk *How to Perceive the Virtual Image? On the Distinction Between Virtual and Real*, delivered at the Transimage conference in Plymouth in July 2016 (Straeubig 2016d). An essay about *In the Eyes of the Animal*, the artwork by Marshmallow Laserfeast that is discussed in the section *Exploring the Virtual* (p. 91) was published in *AMAZE Magazine*, No. 4 (Straeubig 2016h), alongside with an interview I conducted with the artists (Straeubig 2016i).

My arguments about post-human play that are developed below in chapter *Human vs. Machine* (p. 97) build on my presentation *Can Machines Play?*, given at the Cognitive Futures in the Humanities conference in Oxford in April 2015 (Straeubig 2015a). I delivered an initial version of this talk at the Digital Art and Technology Visiting Speakers event in

January 2015 in Plymouth (Straeubig 2015b).

The distinction between theory and practice, addressed in chapter Theory vs. Practice (p. 149), was the topic of the talk *Towards Play Design for Machines* I gave at ISEA 2016 in Hong Kong (Straeubig 2016j). During a five-month secondment at Kin design, London, I was able to develop this connection further by prototyping projects while continuing to work on my thesis. To discuss and disseminate concepts and interim results, I delivered a workshop on play in December 2015, followed by a workshop on VR in February 2016 and one on artificial intelligence and machine learning in March 2016, focussing on links between these topics and design practice. The respective results have entered into the chapters Play vs. Non-Play (p. 49), Virtual vs. Real (p. 73) and Human vs. Machine (p. 97) and have informed my thinking expressed in chapter Theory vs. Practice (p. 149).

Some of the introductory remarks about play as an interdisciplinary topic (see Research Context (p. 2)) that are echoed in section Play and Discipline(s) (p. 151), are based on a joint interdisciplinary presentation (*How) Does Play Matter? A Transdisciplinary Approach to Play and its Relation to Neurobiology, Creativity and Deception*. My colleagues Chun-Wei Hsu, Pinar Öztop, Mihaela Taranu and I delivered this paper at Off the Lip Conference — Transdisciplinary Approaches to Cognitive Innovation in Plymouth (Straeubig, Hsu, et al. 2016).

My constructivist approach towards social systems that include human and non-human participants, a central theme of chapter Human vs. Machine (p. 97), is reflected in the presentation *Let the Machines out. Towards Hybrid Social Systems*, delivered at the AISB 2017 Convention in Bath (Straeubig 2017a). Further speculations on the role of games and AI, based on current developments described in section Game AI vs. Playing Machines (p. 106), are submitted for publication (Straeubig 2020a, (to appear)). The same goes for some thoughts on the communication between humans and machines suggested in section New Social Systems (p. 161) (Straeubig 2020b, (to appear)).

Besides discussing topics and concerns that were emerging in my research, I presented overviews of my progressing PhD project to academic game studies audiences at the Researching Games Barcamp in Berlin (Straeubig 2016f), at the Doctoral Consortium at FDG/DIGRA in Dundee (Straeubig 2016g), at the Doctoral Consortium at the Philosophy of Computer Games conference in Malta (Straeubig 2016a) and at Off The Lip 2017 in Plymouth, published as *Playing with/as Systems: Short Paper, Discussion and Demonstration*

in AVANT (Straeubig 2017b). A poster of my project was exhibited alongside the Neural Basis for Creativity Workshop in Plymouth in April 2016 (Straeubig 2016b). Furthermore, I took part in the panel discussion “Game design for Urban spaces” during the event playin’ siegen in Siegen (Rauscher et al. 2016).

On each of these occasions, the feedback I received and the discussions that came up about the topics emerging during my project have been of the greatest benefit. I also attended several workshops offered during my doctoral program:

- Research Methods Workshop (April 28 - May 2, 2014): Research skills, multi-disciplinary research perspectives, publishing and collaboration.
- Experimental Methods Workshop (June 23 - 27, 2014): Tutorials on various experimental methods, ethics in experimental research, experimental design, data analysis and presentation of research results.
- Computational Modeling Workshop (September 22 - 26, 2014): Lectures and practical tutorials on programming, neuro-comptational modelling, neuro-morphic and bio-inspired hardware and robotics.
- Public Outreach and Social Innovation Workshop (January 26 - 30, 2015): Research impact, public engagement and multimedia production, communicating research to the press and to the general public.
- Project Proposal and Entrepreneurship Workshop (April 27 - May 1, 2015): Potentials for exploitation of research ideas, intellectual property, opportunities for funding, patenting and licensing.
- Scientific Mythologies (January 25 - 29, 2016): Creation of stories and mythologies within the personal and collective imagination, collaborative artistic practice, short film production.
- The Neural Basis for Creativity (April 25 - 29, 2016): Lectures on neuroscience, neural stem cells, creativity and cognitive innovation, tutorials on EEG methods.

These opportunities have contributed enormously to my theoretical and practical progress. Exposing my practice to the public on various occasions in the last 5 years has guided the direction of my theoretical and practical approach and enabled me to evaluate and to advance my work.

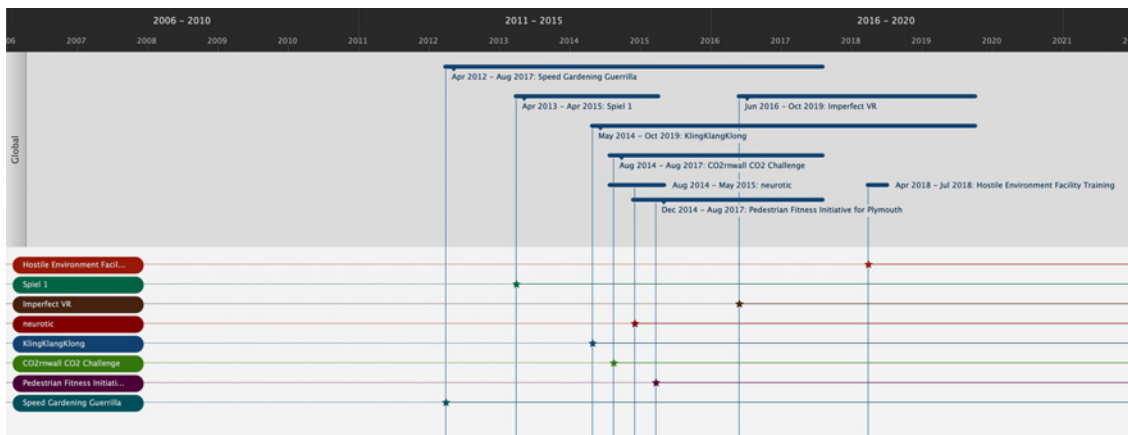


Figure 1: Timeline of practical works

This overview illustrates the timeline of projects that make up the practical contributions of this thesis. *KlingKlangKlong* (Straeubig 2014c), *neurotic* (Straeubig 2014d), the *Imperfect VR* workshops (Straeubig 2016e), *Pedestrian Fitness Initiative for Plymouth* (Straeubig 2015d), *CO2rwall CO2 Challenge* (Straeubig 2014b) and *Hostile Environment Facility Training* (Straeubig 2018a) were created during my PhD project beginning in April 2014. In addition, I re-contextualised, developed and exhibited two older projects of mine: *Speed Gardening Guerrilla* (Straeubig 2012) and *Spiel 1* (Straeubig 2013c).

I presented various versions of *KlingKlangKlong* (see Project: KlingKlangKlong (p. 110)), the first expression of a playful system at Playpublik Festival Krakow in September 2014, at Plymouth Book Festival in October 2014, at playin' siegen in Siegen in April 2015, at MediaCity Plymouth in May 2015 and at Off The Lip in Plymouth in October 2016. In collaboration with Sebastian Quack, I co-wrote the article "Playful Locative Ensembles in the Urban Soundscape" featuring *KlingKlangKlong* in the context of sound art and urban sound ensembles, published as (Straeubig and Quack 2016).

Spiel 1 (see Project: Spiel 1 (p. 57)), initially developed for a fringe theatre event in 2012, was also showcased during playin' siegen. *Neurotic* (see Project: Neurotic (p. 100)), which spawned from *KlingKlangKlong* in an attempt to model a biological system, was shown at Prototype Dublin in October 2014 and at the Plymouth-based Mediacity 5 conference in May 2015.

The *CO2rwall CO2 Challenge* (see Project: CO2rwall CO2 Challenge (p. 130)) was shown at the Fascinate conference in Falmouth in August 2014 and *Pedestrian Fitness Initiative for Plymouth* (see Project: Pedestrian Fitness Initiative for Plymouth (p. 135)) during Mediacity 5. *Speed Gardening Guerrilla* (see Project: Speed Gardening Guerrilla

(p. 138)), an ongoing urban game project that I developed in 2012, was played under the title *Plantación Revolucionaria* at the Playful Arts festival in 's-Hertogenbosch in June 2016. I presented these three projects in a joint exhibition titled *Non-Sense of Place* (see Project: Non-Sense of Place (p. 130)) at the Balance-Unbalance conference in August 2017 in Plymouth.

The *Imperfect VR* workshop series started at Electromagnetic Field in August 2016 in Guilford. Since then I have delivered a number of workshops at diverse locations like Plymouth University, Royal College of Art, Space Art and Technology and Doomed Gallery in London, at Vivid Project in Birmingham, at Maritime University and Donghua University in Shanghai, and at the Social Fiction Lab in Berlin (see Project: Imperfect VR (p. 74)).

Contributors to my practical works are credited in the digital material in the Appendix that is provided with this thesis.

Related Work

Due to the transdisciplinary nature of this thesis, it includes a substantial amount of sources both on the subject of play and on systems theory. During my review of the relevant literature, however, I have found only few existing sources at the intersection of these topics.

From a related, yet different theoretical foundation are Montola (2012b) and Stenros (2015). Their highly valuable contributions to the game studies rest on social constructionist theories, initiated by Berger and Luckmann (1990) and further developed by Searle (1995).

In contrast, my theoretical background is based on distinctions (Spencer-Brown 2008), second-order cybernetics (Glanville 2002), radical constructivism (von Glasersfeld 1992), and in particular on Niklas Luhmann's systems theory (Luhmann 1996). I will develop this particular background, along with my practice-based approach, in chapter Distinction vs. Identity (p. 15), where I also describe the differences from social constructionist theories.²

A more closely related approach has been undertaken by Andersen (2009). Andersen investigates Spencer-Brown's theory to illustrate the distinction between play and work, in particular in the context of management games. I will address Andersen's work in section

²In line with Stenros' terminology, I refer to Berger and Luckmann's theories as "social constructionist", to delineate them from "radical constructivism" (von Glasersfeld 1992).

Andersen and Stott: Play at Play (p. 37).

Stott (2015) applies Luhmann's theories, in particular by observing art as a social system, to play in contemporary, participatory art practice. This work, summarised in section Andersen and Stott: Play at Play (p. 37) is also relevant to this thesis and will re-enter the discussion in section Games vs. Art (p. 63). In (Simon 2009), a collection of systems-theoretic thinking is specifically applied to football.

Chapter 1

Distinction vs. Identity

Draw a distinction!

George Spencer-Brown (2008)

1.1 What Is Play?

Two children are tossing a ball back and forth on a public playground. A group of players coordinates an elaborate raid in the Massive Multiplayer Online Roleplaying Game *World of Warcraft*. An intense match between world class Go Champion Lee Sedol and DeepMind's AlphaGo is coming to a close. Two dogs are simulating a fight while carefully avoiding hurting each other. A group of students constructs a spaceship from a set of wooden blocks. A player meticulously places a matching card onto a deck in the game Solitaire. We can characterise all these situations as play.

Play is ubiquitous — it is hardly imaginable to find any human being that has never experienced play. But when we try to analyse the phenomenon, we face grave difficulties. This is especially observable in academic discourse (see Research Context (p. 2)). Play appears notoriously difficult to analyse and more so to agree upon. Some see it as the epitome of human expression (Schiller 1795), others research the dangers of engaging in it in a pathological way (Hilgard, Engelhardt, and Bartholow 2013). Play can be described in terms of monetary profit (Schwartz 2007) and as the opposite of a commercial endeavour (DeKoven 2014). It is fundamentally cultural (Huizinga 1955), yet observed in lower animals such as fish or birds (Burghardt 2015). It is a highly social activity (DeKoven 2013) and still it can be perfectly experienced alone (Piaget 1962).

In the light of this multiplicity of scientific theories, how can we even account for the diverse contributions from the humanities like Schiller's *Spieltrieb* (Schiller 1795), Huizinga's magic circle (Huizinga 1955) or Caillois' classification of games (Caillois 1961)? We might ask, is it even possible to arrive at a comprehensive description of such a complex phenomenon? I will argue that this endeavor is feasible, based on the prior example of Luhmann's theory of social systems (Luhmann 2012; Luhmann 2013).

Besides these observations about human and animal play described in the literature, more recently a new set of questions has appeared. They concern novel modes of playful involvement for non-biological entities, algorithms and robots, a topic that will be discussed in chapter Human vs. Machine (p. 97).

In my view these findings make it impossible to just give a "working definition" of play and move on, as it was done before, e.g. (Bateson and Martin 2013; Burghardt 2005b; Caillois 1961; Eberle 2014; Huizinga 1955; Sutton-Smith 1999). Instead, I argue, the situation requires an a priori critical reflection of one's own epistemological stance and methodology, the attitude towards what constitutes knowledge and how phenomena are to be investigated, described and explained. I contend that we need a methodology that eschews definitions in favour of distinctions and that combines practice and theory in a novel way.

In the course of this chapter, I aim to make this claim explicit by presenting its general background and by putting forward concrete theoretical groundings. Before that, I want to shed more light on the problem of how we can describe play.

An inescapable premise for any discourse about any phenomenon is that we have to use some medium of communication. Within an academic context, this medium is predominantly language.¹ Therefore, it makes sense to look at the linguistic usage of the word "play" in time and across cultures. Huizinga undertakes such an analysis in the second chapter of his classic study *Homo Ludens* (Huizinga 1955, p. 28-45). Firstly, he notes that languages are widely different in how they denote play and how many terms are available. Some common traits between language families can be identified, for example in Sanskrit, Romanic, Germanic and the Anglo-Saxon languages, early terms for play are rooted in expressions of rapid movement and dance. One may speculate that this was how play was mainly perceived, in children's play as well as in rituals, festivities

¹I say "predominantly" because there are other media such as artworks, which will be discussed later.

and sports-like competition. In Dutch, German, English and Japanese, the word “play” can denote mobility within a restricted space, as in the expression “this hinge has some play”. This has motivated Salen and Zimmerman to metaphorically define play as “free movement within a more rigid structure” (Salen and Zimmerman 2003, p. 304). They further categorise play into three subcategories: play the context of a game, general ludic activities and anything undertaken in a playful state of mind.

The Latin word “*ludus*”, used by Huizinga to characterise human culture in general, has a wide variety of meanings within the semantic field of play and games, like non-seriousness, chance, semblance, contest and practice. The Latin terminology is in use until today, and the adjective “*ludic*” is used to denote attributes pertaining to games and play.² (Frasca 1999) has coined the term “*ludology*” to designate the “discipline that studies game and play activities” independent of a specific medium. However, Frasca also states his intention “to explore video games and cybertexts as games”.³ Subsequently, the usage of “*ludology*” has focussed on the scholarship on video games (Frasca 2003).

The Greek language, unlike Latin, knows a few different expressions that stand for play: the rarely used *παῖδιον*, the suffix *-inda* which stands for children’s play, and the opposites *paidia* (*παιδιά*), derived from childishness and amusement and *agon* (*ἀγών*), which denotes competitive and antagonistic activities.

What can we conclude from these linguistic observations besides noticing etymological differences? In English for example there are different words for game and play, in contrast to languages like Spanish (*juego/jugar*), French (*jeu/jouer*) or German (*Spiel/spielen*). Although one wouldn’t assume that a French-speaking scholar of ludology would be less able to distinguish between connotations of the activity and the structure (or process) than her English colleague, a common language to describe these different phenomena precisely appears to be desirable. The idea that the concepts of a language do determine expressiveness has motivated Roger Caillois to introduce a comprehensive classification of play. Caillois uses a mix of Greek and Latin terms, freely borrowing from their traditional meanings while sorting them into the following four “fundamental categories” (Caillois 1961, p. 12):

²In German language, the word “*Lude*” means “pimp”, bearing similar connotations as “playboy”.

³The term “cybertext” refers to Aarseth (1997). Aarseth, in turn, refers to Wiener (2007) in his concept of nonlinear cybertext, ergodic literature, in which the reader has to exert a certain effort in order to decipher a mechanically arranged text. Hypertext, interactive fiction, the I Ching and adventure games are examples for ergodic literature in that sense.

- Agôn: competition between adversaries including combat
- Alea: giving up agency in favour of independent decision, games of chance
- Mimicry: play as make-believe like role-playing
- Ilinx: play which creates bodily sensations such as vertigo through rapid movement

Caillois adds a second dimension to this schema. “Paidia” is the equivalent of free play, the unregulated, improvised activity, while “ludus” denotes play that overcomes challenges within the rule-bound structure of a game. By providing a taxonomy, Caillois apparently provides a tool to precisely categorise play. If we support a logical positivist position, this would be a desirable result, as in this view the boundaries of language are the limits of our understanding (Wittgenstein 2007).

If we follow Huizinga however, observing play not only as a phenomenon expressed in language but rather something at the core of language itself, as evident in philosophical dialogs, in poetry, conundrums, jokes, metaphors and language games, then we begin to sense a more playful quality of play. With play, we are likely to encounter what Douglas Hofstadter (1999) calls “strange loops”. Strange loops occur when we find ourselves moving up or down linear, hierarchical structures (logical systems, taxonomies, theories, explanations) and then unexpectedly arrive at our starting point. They can be observed in phenomena that are recursive, paradoxical and self-referential.

They are inherent in strict logical structures like the Barber’s paradox, an imaginary situation where inference leads to unresolvable contradiction or Gödel’s self-referencing theorem that states the irreconcilability of expressiveness and consistency in formal systems (Gödel 1931). They appear in artworks such as Escher’s *Drawing Hands*⁴ (Escher 1948) and the apparently endless rising canon in Bach’s *Musical Offering* (Bach 1747). They also can be observed in biological systems, for example DNA encoding for proteins that construct DNA. Hofstadter discusses how strange loops have resisted attempts to eliminate them from science (Hofstadter 1999, p. 684-718) and I claim that we can find them at the core of playfulness.

The playful quality of Gödel, Escher, Bach is also present in Suits’ philosophical treatment of play, by inviting Aesop’s Grasshopper along with a parade of colourful characters to

⁴A concrete embodiment of a strange loop is the Moebius strip, which can be created by taking a strip of paper, twisting it by 180 degrees and joining its ends. Travelling a straight line along the strip becomes an endless journey that periodically revisits the starting point.

discuss, quarrel about and illuminate the concepts of games and play (Suits 1978).

Our first encounter with play has already raised doubts about the feasibility of a reliable definition, one that practitioners across different languages and cultures would accept. Wittgenstein, after giving up on the idea of establishing a correspondence between language and reality, takes a step further by pointing out a principal limitation of any language in defining a particular semantic content (Wittgenstein 1958).

So what is the meaning of “play”? Wittgenstein maintains that for the term “game” the various meaningful references of a word resemble each other in the way families do: one can identify common traits among the members but there is no way to locate precise definitory boundaries. The question for “the” meaning becomes less meaningful, and we are again caught in a strange loop.

Concerning the matter of definitions, Suits rebuts Wittgenstein’s pessimistic assessment and strives to produce a definition of a game, albeit in a dialectic and playful way. According to Suits, playing a game “is to attempt to achieve a specific state of affairs [preludory goal], using only means permitted by rules [lusory means], where the rules prohibit use of more efficient in favour of less efficient means [constitutive rules], and where the rules are accepted just because they make possible such activity [lusory attitude]” (Suits 1978, p. 41). Thus, a game puts artificial obstacles between a goal and a player who is willing to accept that she has to use sub-optimal means to reach the goal. Suits then continues to defend this definition against various counterarguments.

Suits’ entertaining parable is certainly not the first attempt in securing a definitory boundary for games. Science and humanities have been wrestling with definitions and explanations of play for quite some time. Throughout the nineteenth and twentieth centuries, many biological and social scientists put forward theories about play (Ellis 1973; Levy 1978):

Explanations about why humans and animals play range from a surplus of energy (Spencer 1855), instinct (James 1890), task compensation (Escalona 1943), relaxation (Patrick 1916), catharsis (Menninger 1960), assimilation (Piaget 1962), self-expression (Mitchell and Bowen 1923) and social necessity (Huizinga 1955) to psychoanalytic accounts (Erikson 1993), the pursuit of optimal levels of stimuli and arousal (Berlyne 1960) and exercising competence /effectance (White 1959).

Two more recent hypotheses from the field of learning theories, namely the training of motor skills and preparation for unexpected situations, have garnered some experimental

substantiation (Pellis, Pellis, and Bell 2010), but the subjects of their research were rats, not humans.

Some cited theories clearly contradict each other: for example, the assumption that play serves to compensate for otherwise un-playful tasks (Escalona 1943) and play as understood by Pellis, Pellis, and Bell (2010) as a form of training for those tasks. One way to resolve these contradictions, as will be discussed in the next sections, is to add more information, such as historical context, discipline or interest to the description. According to Huizinga, theories and explanations that do not contradict some others, cannot claim completeness, as “If any of them were really decisive it ought either to exclude all the others or comprehend them in a higher unity” (Huizinga 1955, p. 2).

Huizinga, who stresses the central role of play for the development of culture, asserts that a multitude of cultural phenomena like the mythos, poetics, sophistic philosophical rhetoric, contests and matches, the absurd and the fantastic, even some forms of war belong to the sphere of play. He defines play as “[. . .] a voluntary activity or occupation executed within certain fixed limits of time and place, according to rules freely accepted but absolutely binding, having its aim in itself and accompanied by a feeling of tension, joy and the consciousness that it is “different” from ordinary life” (Huizinga 1955, p. 28).

Huizinga’s work has been characterised as a significant point of departure for the game studies (Raessens 2012). On the other hand he is criticised for a colonial attitude towards non-European peoples and for a linearising historical stance (Anchor 1978). Critics also find fault with the broad application of the play concept to cultural phenomena ranging from jurisdiction to pre-modern warfare. This criticism does not stop at Huizinga alone but culminates in a scathing attack against the humanities in general (Tanghe 2016).

Also, the notion of the “magic circle”, an ontologically separate space in which play takes place, albeit peripheral for Huizinga, has been the subject of fierce debates (compare *Is Play Real?* (p. 73)). Caillois explicitly takes issue with Huizinga, and his attempt at categorising and defining play can be read as an excoriating response. According to Caillois’ definition, play is free as opposed to obligatory, separate in space and time from non-play (which is Huizinga’s concept of the magic circle), uncertain, unproductive in creating neither goods nor wealth (see *Play vs. Work*), governed by rules that are alternatives to ordinary laws and make-believe (see *Virtual vs. Real*) (Caillois 1961).

Besides Caillois vs. Huizinga, another example of academic disagreement clearly illus-

trates the problem with definitions. This is the dispute between Brian Sutton-Smith, the eminent game theorist, and Burghardt, the likewise esteemed ethologist and specialist in animal play. Sutton-Smith, who engaged in a lifelong study of psychology and cultural history of play and games, concludes that despite all definitory efforts, play remains inherently ambiguous. His answer to this challenge is to cast play in terms of cultural rhetorics. A rhetoric, in Sutton-Smith's account, is a description that intends to persuade and that is shaped by the interest of a particular group or discipline. He identifies seven of them, classified into ancient (fate, power, identity, frivolity) and modern (progress, self, imaginary) Western rhetorics (Sutton-Smith 1997).

The first rhetoric is progress, which is the way play is rationalised and explained by science (compare *Play and Discipline(s)* (p. 151)). Another one is fate, an ancient rhetoric that locates play in the realms of gods, chance, and destiny. Play as power reflects historical accounts of agonal elements visible in contests and sports. Celebrations, festivals and rituals affirm cultural identities and build communities, another ancient rhetoric of play. The rhetoric of play as imaginary is connected to storytelling, drama and literature and questions the reality of society (compare *Actual vs. Potential* (p. 83)), whereas play from the perspective of self is about the subjective experience of it (compare section *Paradoxa of Play* (p. 69)). Finally, play as frivolity represents a counterbalance to seriousness (see *Play vs. Purpose* (p. 54)), even an "[...] opponent to the seriousness of all the other rhetorics" (Sutton-Smith 1997, p. 201).

For Burghardt, the scientific practitioner explicitly interested in a working definition of play, Sutton-Smith's approach "does not solve any real issues about play" (Burghardt 2005a, p. 9). In Burghardt's somewhat forlorn response, one can almost feel a wall of despair standing between the sciences and the humanities (see *A Third Culture?* (p. 149)).

Burghardt also offers his own definition of play as follows: "Play behavior is recognized by five criteria. Playful activities can be characterised as being (1) incompletely functional in the context expressed; (2) voluntary, pleasurable, or self-rewarding; (3) different structurally or temporally from related serious behavior systems; (4) expressed repeatedly during at least some part of an animal's life span; and (5) initiated in relatively benign situations" (Burghardt 2005b, p. 382). In addition, Burghardt postulates four necessary conditions for play in animals: sufficient available energy resources, an absence of danger and stress, the presence of adequate stimulation and the facility for complex behaviour. Play in his

view then becomes a phenomenon that develops amidst a surplus of resources.

Sutton-Smith later commits to a definition of play in an essay he describes as “A footnote to The Ambiguity of Play”: “Play, as a unique form of adaptive variability, instigates an imagined but equilibrated reality within which disequilibrium exigencies can be paradoxically simulated and give rise to the pleasurable effects of excitement and optimism. The genres of such play are humor, skill, pretense, fantasy, risk, contest, and celebrations, all of which are selective simulations of paradoxical variability” (Sutton-Smith 1999, p. 253). This explanation appears to me almost playful in its obscureness, which fits with the general speculative and ironic tone of Sutton-Smith’s essay. But it is questionable that this particular definition would solve Burghardt’s concerns either.

Eberle (2014) calls it “circular, incomplete, and difficult to unpack”, and he notes that the concept of variability hints towards play as an emergent process rather than a thing. Eberle then defines play himself from two angles. One is through an analysis of six elements which he identifies as anticipation, surprise, pleasure, understanding, strength, and poise. The other is from a demarcation of its opposite, namely from the question what play is not. These opposites are listed as obsession, shock/terror, excess, indifference, heedlessness and abstraction. This dialectical movement finally arrives at Eberle’s definition: “Play is an ancient, voluntary, ‘emergent’ process driven by pleasure that yet strengthens our muscles, instructs our social skills, tempers and deepens our positive emotions, and enables a state of balance that leaves us poised to play some more” (Eberle 2014, p. 231).

This first glance at previous research about play has already resulted in a multitude of partial and irreducibly conflicting theories and definitions. Even in the face of an apparent abundance of voices, I would describe the situation as a deficiency of theory.⁵ It is impossible to apply a comprehensive description of play which suggests that it is necessary to clarify epistemological issues first.

Here and in the following sections, I am arguing why “definitionist” attempts must fail to provide a comprehensive description of play. I claim that this is not because any of the particular definitions that are brought forward turn out to be flawed, but rather because in principle no phenomenon that spans individual, social and cultural realms, as opposite to pure theoretical entities within formal systems, can be defined.⁶ The problem is rooted in

⁵This assessment can hold because theories, as constructs of knowledge, are not additive (Kuhn 1962).

⁶We are used to accept, even to require definitions as preconditions of proper academic analysis. “How do you define play?” is the first question I often get asked, and my answer begins with “I don’t define play, but I observe it through distinctions.” This qualification, detailed in the current chapter, turns out to be crucial, as a

the very idea of a definitory approach itself.

In the next section I will focus at the question of how we can possibly arrive at an answer to a question such as “what is play” and return to the topic of play proper in the following chapter Play vs. Non-Play (p. 49). First, I will translate the observations described above into conditions for a comprehensive description. Then I will look for suitable theories and approaches to practice that are capable to provide such a description.

1.2 Definitions vs. Distinctions: What Is “Is”?

Let me take a step back and pretend for a moment that the present discussion is not about play, but about a phenomenon “X” (to avoid all conceptual associations). In the previous sections I would have outlined how there may be multiple explanations and definitions for X arising from various disciplines, some conflicting each other, while others appear to be commensurable. Scientists and some cultural scholars aim to define X, while others, like Sutton-Smith, are rather sceptical towards this approach.

What constitutes the problem about various attempts at definitions for X regardless of the details of definitions themselves? It is that a definition marks a referential identity between the concept to be defined (*definiendum*) and the defining statement (*definiens*), expressed in the structure “X is (defined as) Y”. As Audi notes, definitions are analytic tools to secure both necessary and sufficient conditions (Audi 2002).

In formal proof theory (Negri and von Plato 2008), where the goal is to deduce a theorem from a set of axioms, definitions provide shortcuts. They allow to replace each occurrence of Y by X, thereby reducing the effort to explicitly enumerate Y each time. This principle of substitution is at the core of a definition. It therefore has to draw a sharp line around what is to be defined: the definition must separate X from non-X. But it also identifies X with Y. It also follows that if two definitions contradict each other (X is Y1 and X is Y2 and Y1 is incompatible with Y2), then we have to reject one of them in order to substitute the other one.

These aspects of a definition are inseparable. We cannot get rid of any one of them without the definition losing its essence. Definitions are defined this way, a strange loop in Western logic and the formal sciences that have adopted definitions and categorisations

mere refusal to specify one's terms in my opinion would be not an acceptable methodology.

(Lakoff 2012) as their dogmata, largely unchallenged by the knowledge-producing systems (Luhmann 2009, p. 271-361).

In section What Is Play? (p. 15) I have described how Wittgenstein's critique — via the concept of family resemblance — attempts to loosen the definitory boundary by replacing it with a set of weaker relations. This approach, however, stays firmly within identity-based approaches. Despite all (post-)modern critique, game studies scholars keep insisting on definitions (see for example Bergonse (2017) and Arjoranta (2019)). This ignores fundamental challenges, such as the deadlock of definitions in the wake of paradoxical findings. If play is an activity whose purpose is to practice motor skills, then play is rather not a vehicle to escape from reality. Except it would be both at the same time, in which case, from the perspective of evolution, we could ask what went wrong in terms of adaption towards a more efficient mechanism.

David Myers (2017) demonstrates a particular method for observing video games. His approach is to select a number of distinctions, cross to the respective other sides, and observe games from there. Myers generally acknowledges paradoxical phenomena of games. However, the essentialist opinionated ductus accompanying his particular selection of observation tools, comprising narratives, gameplay, toys and simulations, among others, reduces the usefulness of this account. Claiming to deliver the “definitive guide to what video games are” carries an ontological entitlement that is, to say the least, questionable.

To get out of the “identity trap” and make progress in investigating play, I claim, we need to operate differently. Before I drop definitions and categorisations of play as epistemological tools and replace them with a more fundamental mechanism, I will summarise my findings so far in form of seven requirements for a comprehensive description of play.

1.3 Requirements for a New Paradigm

Having raised some issues associated with attempts at explanations and definitions of play, I now want to begin to ask how we might arrive at a comprehensive description of play. In particular, I propose seven conditions that any comprehensive description of play should fulfil⁷. This will allow a search for suitable candidate theories and help to delineate

⁷This section contains is a revised version of (Straeubig 2017b). The linear nature of language and the sequence of argumentation makes it necessary to present these conditions in a completed state at this point. However, they result from multiple iterations between reviews of literature, theoretical construction and my practice

inadequate ones.

The first condition is an adequate level of abstraction: The description has to be abstract and general enough to cover the wide range of phenomena that are observable as play: free play between children, the ritual of a sports match, non-human (e.g. animal) play, the drama unfolding during a game of chess, meta-rules emerging from a multi-player online battle, unpleasant, forced, and dark play (see *Play vs. Dark Play* (p. 67)), or the experiential quality of a playful encounter between adults. These and many other phenomena have to be considered in a description of play. As this requires a high grade of abstraction, I contend that it must have a simple, universal foundation.

The second condition is a sufficient level of theoretical complexity: the description must be expressive enough to account for the complexity of the phenomenon observed. This complexity comes as an abundance of relations between elements, which requires making conscious decisions about which perspective to inhabit. In Luhmann's words, "Complexity, in this sense, means being forced to select; being forced to select means contingency; and contingency means risk" (Luhmann 1996, p. 26). We trade in the risk to perturb (see Maturana and Varela: *Perception Is Distinction* (p. 32)) existing academic conversations against the prevalence of historically generalising explanations of the kind "play is getting rid of surplus energy" (Spencer 1855) or current postmodern accounts like "play is capitalism" (Nash and Penney 2015). To analyse the latter through a critique of video games as "the aesthetic form of rationalization" (Pedericini 2014) we need to observe the distinction between play and games (see *Play vs. Games* (p. 65)). We can therefore reject Pedericini's account with the help of Suits' observation that despite superficial similarities manifest in themes or mechanics of games, games are exactly the opposite of rationalisation. They represent the aesthetic form of unnecessary effort⁸ (see *What Is Play?* (p. 15)). Increasing the number of distinctions in one's observation, in accordance with von Foerster's ethical imperative (see *Von Foerster: Second Order Cybernetics* (p. 29)) allows to observe complexity with higher precision.⁹ This does not mean that all distinctions are equally useful. If Hans (1981) claims that everything is a form of play, he then has to explain a phenomenon like work as a special kind of play, and start drawing distinctions between these special kinds instead of observing the phenomena themselves (compare *Play vs.*

⁸Pedericini notices this contradiction but keeps insisting that "the act of playing, especially a computer-assisted, cybernetically-biased variety, can cultivate the capitalist mindset and value system" (Pedericini 2014) (see also *Play vs. Learning* (p. 56)).

⁹Note that this and the previous condition act in an antagonistic manner. A high level of abstraction pulls in the direction of simplicity. High complexity pulls in the opposite direction.

Non-Play (p. 49) and Counterpoint: Machines Play (p. 118)). Monocausal explanations, be it play, capitalism or evolution, inevitably run into intellectual acrobatics.

The third condition for a comprehensive description of play is that it must account for paradoxical and contradictory findings and it must endure the presence of strange loops. Is play the biological function to practice useful behaviour (Pellis, Pellis, and Bell 2010), or is it the ambiguous phenomenon that is best described in the form of cultural rhetorics (Sutton-Smith 1997)? Are we biological systems observing play as biological behaviour? Or is playfulness in the mind, along with reasoning about playfulness? To make sense of contradictions, one can add context to the description. In particular, one may choose to not only describe the conflicting observations but also the observers that are involved. If animals play and if ethologists postulate play as a biological function, we can observe and explain this fact because ethology is based on functional explanations (see *Play vs. Purpose* (p. 54)).

Condition number four postulates that it must be possible to express observations about play from a first-person perspective (McGinn 1996): Any description that excludes subjective experience and relies solely on observation from the “outside” (third person perspective) remains incomplete. This entails that scientific accounts that purely insist on objectivity, empirical data, measurement and replication may be a necessary but certainly not a sufficient component of a comprehensive description of play. When we cannot grasp the multiple facets of play based on scientific methods alone, non-objective approaches such as introspection (Wiener 1990) and stochasticity (Stanley and Lehman 2015) are to be taken seriously as well.

From the previous four requirements immediately follows a fifth one: any comprehensive description of is necessarily transdisciplinary: To fulfil conditions for expressiveness, abstractness and handling contradictions, we must be able to look beyond any singular discipline that is tied into its specific methodologies and research goals. This entails that there cannot be an all-encompassing, mono-thematic explanation rooted within a specific discipline, ideology or theory like biology, child development or Marxism.

In his attempt at a definition of play, Sutton-Smith states that he hopes to achieve concilience, convergence of sciences and humanities, by “creating a homogeneity of definitional layerings” (Sutton-Smith 1999, p. 239). As hinted at above, I do not share the teleology of unification, but intend to observe various phenomena of play from different

angles to find out more about them and contribute to a deeper understanding. A trans-disciplinary approach appears to be useful in this respect because it does not strive to level, reduce or deny observations from different fields. Transdisciplinarity instead requires one to acknowledge disciplinary foundations and methodologies while developing a critical stance towards them (Blassnigg and Punt 2013). I will pick up the context of disciplines again at a point when I will be able to summarise my findings (Play and Discipline(s) (p. 151)).

I also posit the necessity for a sixth condition: the description has to bridge theory and practice. In analogy to Magritte's famous point about referentiality (Magritte 1929), this postulate stresses that communication (including writing) about play cannot exhaust what it is to be playing. This entails the first person perspective which I have called for in the fourth condition: by playing, designing, playtesting and tinkering, the phenomenology of play unfolds in the individual mind prior to any written or verbal communication. Thus what I denote as "description" must include aspects of both theory and practice. Considering the previous condition, it is imperative to observe a multitude of practical approaches, without prerogative for any particular, say scientific, methodology. This includes experimental methods, empirical science, prototyping, play and game design practice, critique, computational models, speculative design, and experiential aspects (see Paradoxa of Play (p. 69) and Play and Discipline(s) (p. 151)).

The label I have given to my methodology is *research informed practice* or equally *practice informed research* (see Meta-thetical Dialog (p. 165)). The reason for this will emerge through the discussions of the practical projects including in this thesis (see Project: Hostile Environment Facility Training (p. 40), Project: Spiel 1 (p. 57), Project: Imperfect VR (p. 74), Project: Neurotic (p. 100), Project: KlingKlangKlong (p. 110), Project: CO2rwall CO2 Challenge (p. 130), Project: Pedestrian Fitness Initiative for Plymouth (p. 135) and Project: Speed Gardening Guerrilla (p. 138)) and it will be contextualised in section Play and Discipline(s) (p. 151).

My research informed practice includes descriptions that are demonstrations, interactions and playful experiences which I have designed, played and exposed (Schwab and Borgdorff 2014), creating a small, multimodal, intertextual (Kristeva 1980) cohort of material to make use of in this thesis. Language as a medium of communication is necessarily restricted to a secondary observation of something that is inherently experiential — the

phenomenological encounter of the player in her first-person perspective itself. Thus, an indispensable mode of learning about play is playing. This introduces the next paradox, when we consider play unique with respect to the absence of an external purpose from a first-person perspective (see Play vs. Purpose (p. 54)).

Finally, a seventh condition transcends the boundaries of any singular act of communication. *Anschlussfähigkeit* (connective capability) is a term borrowed from Luhmann's theory that denotes an intrinsic characteristic of social systems (Luhmann 1996). Such a system, which operates with communication, ceases to exist immediately if there are no follow-up events responding to previous events. A conversation dies from a lack of responses, an institution gets shut down, a theory is forgotten. To enhance the probability that communication can continue, a comprehensive description of play must therefore ensure its connective capability (for example, by continuously publishing articles). However, the necessity of further communication does not imply favourable assessment: critique, even a blunt rebuff, is an appropriate continuation for descriptive discourses, if it does not lead to the silencing of the criticised.

In this section I have shifted the observation from play itself to conditions that I deem necessary for a comprehensive description of play, derived from observations about previous identity-based approaches. Now I am prepared to assemble in the following sections the practical and theoretical background capable of delivering on these requirements.

1.4 Spencer Brown: Draw a Distinction

"The theme of this book is that a universe comes into being when a space is severed or taken apart", writes George Spencer-Brown (2008) in *Laws of Form*, an ontological statement with biblical connotations. In the story of creation, we learn that God created the universe within 6 days merely by drawing distinctions.¹⁰ Distinctions are fundamental not only for a deity but also, as Spencer-Brown contends, in the rather human "desire to distinguish" (Spencer-Brown 2008, p. 69). In the course of the book, the reader is guided through a series of instructions, beginning with the first imperative: "draw a distinction". The outcome of this process is the construction of a calculus of forms with applications in logic and mathematics.

¹⁰In Christian narrative, the initial distinction can be found in the Old Testament in the first chapter of the Genesis: "In the beginning God created the heaven and the earth" (Collins Staff 2011).

By drawing a distinction and indicating one of its sides, two states are created, one of which is marked while the other remains unmarked. From that basic operation, Spencer Brown constructs a calculus that can be used to express mathematical and logical statements. It has been discussed if Spencer-Brown's calculus is nothing more than an isomorphic recast of Boolean algebra (Cull and Frank 1979). However, I do not follow a mathematical path into Spencer-Brown's calculated play with arithmetic and algebra (see for example (Banaschewski 1977)). Instead, I will focus on the form itself, the operations of distinction and indication and on the characteristics that make them suitable to solve the problems associated with identity-based approaches (see *What Is Play?* (p. 15)). To indicate anything, we must first draw a distinction. The distinction separates the space; the indication marks the side of the observer's attention.

What is the distinction between a definition and a distinction? On first examination they seem structurally similar, as both draw a boundary and the indication marks a concept just as the definition does. However, a definition cements its boundary. Something either falls inside the definition or it is outside (something "is A" or "is not A").¹¹ The boundary becomes impassable without changing the definition. There is no other side to cross into. While a distinction separates and connects its sides at the same time, a definition is only interested in its inner side.

That crucial quality of distinctions — as I am using them — is that they do not resist crossing to the other side while leaving the distinction intact. The token that signifies the distinction for me first and foremost signals an invitation to cross the distinction. I will follow this mode of operation throughout this thesis, playing with distinctions.

1.5 Von Foerster: Second Order Cybernetics

First order cybernetics, publicised by Norbert Wiener in 1948, introduces the notion of dynamical systems that are regulated and are regulating themselves by inner and external feedback loops. Synthesising these concepts enabled Wiener to describe the behaviour of a system through its elements (Wiener 2007). The resulting performance may still be complex and unpredictable, requiring stochastic means of analysis.

Second-order cybernetics was born not much later, during the 1960s (Mead 1968; von

¹¹A proposal for a logic that includes a third (rejection) value can be found in (Günther 1962).

Foerster 1995). Mead envisioned cybernetics as a common language for political and scientific systems and as a self-referential tool for complex systems. Maturana and von Foerster introduced a fundamental entity into the investigation in addition to the observed system, that is the observer itself (Glanville 2002).

At the same time, observers and observed retain their status as “black boxes”, initially opaque systems that are coupled through the observation (Ashby 1956). Black boxes can be opened, but then new black boxes appear (Glanville 1982).

Thus, in the framework of second-order cybernetics, we are observing observers (Glanville 2002). Pickering, observing major figures of British second-order cybernetics, has identified another quality of second-order cybernetics he calls “ontological theatre”. According to Pickering, ontological theatre is a mode to engage with the world in a performative manner, as opposed to the causal, homogenous nature of mainstream science (Pickering 2011, p. 17-33).

Ashby regards cybernetics as a glue between disciplines because it is able to construct isomorphisms between concepts (Ashby 1956). As I have argued in Straeubig (2015c) the glue can be provided by distinctions, as they hold both of their sides together (see Spencer Brown: Draw a Distinction (p. 28)).

A further expression of cybernetic thinking is von Foerster’s ethical imperative: “Act always to increase the number of choices” (von Foerster 1973, p. 227). This is an interesting difference to Kant, who postulated ethical behaviour as conforming to a universal principle.¹² The latter confirms identity, the former creates variety.

The dependence on observers in second-order cybernetics leaves us with an epistemological challenge. How can a resilient point of view be established, if all perception, human and non-human, consists in a recursive web of mutual observations?

1.6 Constructivisms vs. Constructionisms

For a long period of philosophical thinking, Descartes’ *cogito ergo sum*, rooted in scepticism, provided a secure ontological mounting point (Descartes 1998). Later Kant (2007) identified time and space as final certainties. But these positions have long been under-

¹²Kant’s maxim is quoted as “Act only according to that maxim whereby you can at the same time will that it should become a universal law” (Kant 1993, p. 30).

mined in postmodern positions that claim universal explanatory pattern in phenomena such as capitalism (Nash and Penney 2015) or declare an era of post-truth (see Reality vs. Truth (p. 88) and Discussion (p. 131)).

Nourished by growing doubts about the naïve assumption of an objective reality (see The Meaning of “Meaning” (p. 87)), various new schools of thinking emerged during the 20th century that in some form assume a constructed nature of reality. The general notion of constructivism originates in the work of Jean Piaget, who has become a central figure in pedagogic thinking. Piaget has largely contributed to our knowledge about play and learning in the context of the development of children (see Play vs. Learning (p. 56)). Influenced by Piaget, Seymour Papert established at MIT a methodology of learning through making, a practice that is situated, embodied and aware of the environment (Papert and Harel 1991; Ackermann 2001).

Another direction of constructivist thinking formed in the 1970s under the label “Radical Constructivism” (von Glasersfeld 2005). It has a good deal of personal and thematic overlap with second-order cybernetics. Among its main representatives are Heinz von Förster, Ernst von Glasersfeld and Paul Watzlawick. Prominent topics include evolution, self-organisation, complexity, systems and the concept of autopoiesis. A difference to cybernetics with its interdisciplinary (compare Von Foerster: Second Order Cybernetics (p. 29)) and practical character (see Theory vs. Practice (p. 149)) lies in the role of radical constructivism as an epistemological theory. Central to this philosophy is the assumption that any contact with reality is necessarily a construction by an observer. Radical Constructivism does not deny reality as such but rather is agnostic about it. However, constructivist epistemology discards assumptions about an outer reality being represented by mental events. Instead, reality itself is constructed through observations and communication (Watzlawick 2011). Each individual organism or mind constructs its own reality through perceptions and prior to any social interactions. This position is “radical” in the sense that it posits perception as an action, not a passive reception of an external world impinging on the senses. Constructions occur not only within the social sphere but already on the level of biological systems. An example is the frog’s eye that is evolutionally optimised to perceive movement (compare Maturana and Varela: Perception Is Distinction (p. 32)), resulting from a complex interplay of structure and function between a system and its environment (Oakley and Speiser 2015).

This is a different proposition than “Social Constructionism”, the theory brought forward by (Berger and Luckmann 1990). Raskin (2002) provides a detailed excursion into the differences between these schools of thought. Social Constructionism popularised the thesis that reality is constructed on the level of social systems, in the systems-theoretic formulation of Luhmann: through communication. This idea is the fundament of contributions by Montola (2012b) and Stenros (2015) previously mentioned in section Related Work (p. 13).

This very brief survey of the vast constructivist landscape ends with the assessment that my position is influenced by the epistemology of radical constructivism on the theoretical side while I am embracing the practical approach of Papert’s constructionism (see also Summary: Puzzling (p. 46)). One important aspect is the question: What are systems actually constructing when they construct a reality? The answer is: themselves. This appears to be another strange loop that I address in the following sections.

1.7 Maturana and Varela: Perception Is Distinction

The Chilean biologists Humberto Maturana and Francisco Varela, both connected to cybernetic (see Von Foerster: Second Order Cybernetics (p. 29)) and radical constructivist circles (see Constructivisms vs. Constructionisms (p. 30)) developed their constructivist biology in the 1970s.

Their central observation is that living systems are constantly (re-)constructing their own elements, which includes the organisation of their own sensory apparatuses (Maturana and Varela 1980). This is the meaning of “autopoiesis”, a term coined by Maturana in difference to “allopoiesis”, where an external process or entity produces an item.

Both Maturana and Varela have strived to extend their epistemology beyond biological systems. Their research suggested that experience is not a passive act, but that the perceiving subject is actively constructing its perception. This led Maturana to the assertion that from biological principles alone the assumption of a given “objective reality” cannot hold. Autopoietic systems self-organise through their recursive network of operations, while any impact from the environment (compare System vs. Environment (p. 123)) is perceived as an irritation (Maturana and Pörksen 2004).

In line with the cybernetic and constructivist approaches mentioned above, the episte-

mology of Maturana and Varela rests on the concept of an observer.¹³ Yet if an observer constructs reality, her internal structure must limit what she can and cannot experience: this is the postulate of structural determinism:

“[...] due to the nature of autopoietic organization itself every change that an organism undergoes is necessarily and unavoidably determined by its own structure which embodies its organization” (Maturana and Varela 1980, p. 120).

The capacity to distinguish a light vs. dark boundary, for example, is built into the retinal cells. Their structure, developed through an evolutionary process, determines what can be seen and therefore perceived (von Foerster 2003). This example shows that perception is a perception of distinctions. Furthermore, it confirms that perceptions made by similarly structured biological systems are by and large similar, while, as Thomas Nagel noted, we cannot even come close to experience the world of a creature that is constructed differently (see *Exploring the Virtual* (p. 91)).

Thus structural determinism explains why realities, while constructed individually, are largely compatible between individuals. The second part of the answer rests on the process of interpersonal reinforcement through communication.

This, however, poses a problem, as communication is a phenomenon quite different from biological processes: it involves meaning. It constitutes a gap in Maturana and Varela's philosophical thinking, which is still rooted in biological principles. To observe play comprehensively, including phenomenological, aesthetic, social and political aspects, a universal theory of systems is required. Enter Niklas Luhmann.

1.8 Luhmann: Distinctions Create Meaning

Encountering the term “system” in modern discourse is akin to a consultation with something liminal and impalpable. This is not surprising, given the abstraction of the subject and variety of system theories that have sprouted in the twentieth century — see (Arnold 2014) for an overview.

Also, for a long time systems theory has been dominated by the notion of complex systems. Complexity theory as a branch of applied mathematics (Arora 2009) establishes

¹³Variations of this idea have come up in various other contexts, such as the observer effect in quantum physics (Feynman and Davies 2011, p. 115-138) or in Gadamer's hermeneutics (Gadamer 2004).

quantitative theoretical results while statistical methods are concerned with the reduction of complexity. Computer science can be seen as a laboratory for complexity by creating dynamic, interactive simulations and systems, including artificial intelligence (Russell and Norvig 2010), artificial life (Cagnoni, Mirolli, and Villani 2013) and artificial social systems (Salge 2012; Kollman 2012; Miller and Page 2007). Various notions and models of complex systems are developed in the sciences, ranging from physics, chemistry and biology (Strogatz 2014; Bonchev and Rouvray 2005; Salthe 2003) to psychology (Guastello, Koopmans, and Pincus 2009), economics (Schredelseker and Hauser 2008) and the social sciences (Byrne 2014). Theories of complexity do not form a singular, coherent body of science, but a (complex) network of theories and observations, loosely connected through common characteristics like collective, emergent behaviour, signalling and information processing and adaptation (Bar-Yam 1997; Mitchell 2011). In Luhmann's theory, a system is complex when it cannot actualise each of its elements simultaneously and some of them have to remain potential (compare Actual vs. Potential (p. 83)).

Theories of complex systems rest on the distinction between the system and its elements, between the whole and its parts. To be able to distinguish between different systems, however, another distinction has to come into play, the one between the system and its environment (see also System vs. Environment (p. 123)). Luhmann's system theory adopts system vs. environment as the relevant distinction (Luhmann 1996) based on earlier ecological concepts by Ludwig von Bertalanffy (Bertalanffy 1950; Bertalanffy 1968) and Talcott Parsons (2017). This enables the observation of systems as autopoietic entities that react to environmental effects with self-irritation: "Irritations arise from internal comparison of (initially unspecified) events with the system's own possibilities, especially with established structures, with expectations" (Luhmann 2012, p. 66-67). Systems then keep operating on their irritations with their own operations.¹⁴

Luhmann distinguishes between biological, psychic and social systems. Cells, organs, brains, organisms and ecosystems are examples of biological systems. They represent individuals in the sense of Huxley (1912), that they cannot be cut in part on risk of losing their specific characteristic as systems.¹⁵ These systems operate with transcription of DNA, activation potentials, and transport of pheromones.

¹⁴Thus the term "irritation" does not have the irritating connotation it has in everyday language. An alternative translation I would suggest is "perturbation".

¹⁵As Huxley (1912, p. 144) notes, there are species like the flatworm that can be divided and will regenerate themselves in an autopoietic operation.

Psychic systems, or minds, on the other hand, operate with thoughts, intentionality and meaning (the topic of meaning will come back in section The Meaning of “Meaning” (p. 87)). Their special attribute is that they can only be observed from the first-person perspective. Everyone has exclusive access to their own mind, which is a completely different phenomenon from the observation of the brain through imaging techniques by a scientist. This is not to postulate a distinct materiality of the mental as it has been suggested in the so-called Cartesian dualism (Descartes 1998), but to concede that minds must be observed through different distinctions than biological processes. Minds also operate in an autopoietic manner: thoughts beget thoughts, intentions conflict with each other, doubts are resolved or they proliferate.

For Piaget, the mind constructs and adapts to its own reality but it still can reach out to things: “These two aspects of thought are indissociable: It is by adapting to things that thought organizes itself and it is by organizing itself that it structures things” (Piaget 1952, p. 8). Autopoietic systems, however, are closed under operations that are dealing with the irritations from their respective environments (see Maturana and Varela: Perception Is Distinction (p. 32)).

The same goes for social systems, which in turn are different from minds and brains. Social systems communicate. Examples are: a discussion, a mailing list, a social network, a game taking place, a protest march, a scientific publication including its production, dissemination and reception, a research group, a religious community, art, economy and law as subsystems of society, and society itself. In a mode between open and closed systems, social systems are operationally closed, which is the same as to say that they operate autopoietically by re-constructing their own elements of communication.

We can then observe play as communication through social systems in terms of cultural, political, economical aspects, in biological systems by observing physiological processes present during the activity, and as psychic systems from the first person perspective. A question that arises is how different systems are capable of interacting. It is undeniable that a mind is dependent on the brain, a playing brain activates neurons in certain areas, which causes the production of hormones within glands that correlate with the player’s feeling of excitement. Other changes to the biological system such as the influence of drugs or an injury will affect the operation of the mind, as irritations that are met with system-immanent operations (see above).

This principle is reflected on the level of different social systems as well. Say, for example, that an ongoing football match is interrupted by a streaker, an unclothed person that is crossing the field. A few seconds ago the players were “in the game”, the team on the offence pressing towards the much-needed equaliser, the other team resolutely defending its goal from the oncoming strikers. Now the situation has changed drastically: the game is interrupted, security personnel are chasing the intruder, the audience reacts audibly with a mixture of amusement and impatience. The game, as a social system, structures its intrinsic communication between the involved players, referees, rules, statutes, league tables, and reactions from the audience. This does not include the streaker who, despite kicking the ball into a goal, would not be able to score. Instead, the ball is considered “out of play”, play is stopped by the referee, and it has to be restarted with a dropped ball. Yet the same action by the streaker could be completely ignored if the referee decides no “interference with play” took place. All this is determined through game-immanent communication between the referee, the players, and the rules, where the appropriate procedures are laid down (The International Football Association Board 2018). A structurally similar, yet completely separate subsystem of society then takes care of the interrupting offender, based on criteria outside of the game like a previous criminal record or the defendant’s readiness to confess.

This observation of systems is grounded on distinctions instead of on identities. In particular, Luhmann adopts George Spencer Brown’s concept of distinctions (see Spencer Brown: *Draw a Distinction* (p. 28)) as the fundamental operation of observation. Luhmann explains how a distinction separates and connects at the same time: “The concepts of distinction and form do not imply negation. The other side remains presupposed when something determined by that side is indicated” (Luhmann 2000, p. 36).

A significant accomplishment of systems theory is that it offers the opportunity to observe these systems as conceptually distinct, resisting the urge to reduce or unify them. Therefore, we can win selectivity in our observations as requested in section Requirements for a New Paradigm (p. 24). In addition, a general theory of (social) systems itself constitutes a (social) system, and therefore the theory must provide a sufficient abstraction and complexity to observe itself – with all the possible paradoxes and theoretical problems such as the question of ontological genesis that follow. This is the realisation of strange loops, not in a meta-theoretical sense but built into the theory itself. Luhmann’s work is constructed on its premise: a theory that is able to observe itself through distinctions.

There are two ways in which I diverge from Luhmann's systems-theoretic framework. One is scope — whereas Luhmann himself has focused his investigations on social systems to describe the whole of society, I will focus on the single phenomenon of play while dancing between different types of systems (biological, psychic, social). The second point concerns the role of machines. Whereas Luhmann observed the machines he encountered in his time as allopoietic systems that are not coupled to minds and therefore not capable to participate in social systems (Luhmann 1996, p. xxi), I will argue in chapter Can Machines Play? (p. 97) and in section Autopoietic Machines (p. 157) for the invitation of machines into social systems (Straeubig 2017a).

The literature about games and play that I have surveyed has by and large treated systems from a complexity and first-order cybernetics viewpoint (compare Von Foerster: Second Order Cybernetics (p. 29)), especially under aspects of games as rule-based systems and systems of control, e.g. (Fullerton 2008, p. 111-140), while ignoring second order cybernetics and the system vs. environment distinction. Salen and Zimmerman (2003, p. 48-55) mention it while referencing Bertalanffy, but they depict the environment as an element of the system. Most notably, Ian Bogost's invention of a theory based on a concept he calls "units" is founded on a grave misunderstanding of modern systems theory.¹⁶

In the next section, I discuss two further contributions that observe aspects of play from a distinction-based and social system perspective, respectively.

1.9 Andersen and Stott: Play at Play

Tim Stott (2015) investigates play elements in performative contemporary art. He discusses artworks such as *Frisbee House* by Carsten Höller (2000), *Stadium* by Maurizio Cattelan (1991) and *Platform* by Sophie Warren and Jonathan Mosley (Warren and Mosley 2006).

¹⁶Bogost (2006, p. 4) writes about systems theory: "The first form of complexity was conceived in the 1940s, as biologist Ludwig von Bertalanffy's systems theory. Systems theory focuses on the interrelation between parts of a system as the primary basis for understanding that system." As I show in this section, this constitutes a misrepresentation of Bertalanffy's system vs. environment oriented approach. The confusion goes on a bit later (Bogost 2006, p. 6) "Sociologist Niklas Luhmann extends the same privilege to social systems, which he claims regulate themselves by 'creating and maintaining a difference from their environment, and [using] their boundaries to regulate this difference.' In Luhmann's systems theory, communication is the basic unit of social systems. System operations are thus totalizing structures that seek to explicate a phenomenon, behavior, or state in its entirety. Unlike complex networks, which thrive between order and chaos, systems seek to explain all things via an unalienable order." In this claim, Bogost gets the system vs. environment distinction right, but his remarks about "totalizing structures" and "explain all things via an unalienable order" are far from anything that Luhmann has written. Bogost completely fails to identify the constructivist, cybernetic, observer-dependent background of the theory. Rather, he goes on and develops a full ontology from this misreading of systems theory.

Those examples serve Stott as a canvas to apply systems theoretic thinking to participatory art to arrive at a formal critique of playful participation. Less formally, Claire Bishop has called socially engaged participatory art “artificial hells” (Bishop 2012), claiming that activation of the audience in participatory art keeps a distance “[..] art and the social are not to be reconciled, but sustained in continual tension” (Bishop 2012, p. 278).

These tensions can be analysed further, especially if art as a social system is accessible to a coherent and consistent observation (Luhmann 2000). Stott makes Luhmann’s theory of social systems and second-order cybernetics available for an observation of play in the context of performative art. In a similar manner, Andersen applies Spencer-Brown’s theory of distinctions to illustrate the distinction between play and work, in particular in the context of management games (Andersen 2009).

I have included both Andersen and Stott in section Related Work (p. 13) because they observe particular aspects of play from similar perspectives and with similar tools as I do, yet both contributions are different in scope and depth. I discuss themes and issues surrounding both approaches further in sections Play vs. Work (p. 51) and Games vs. Art (p. 63).

A further aspect of my PhD project is the integration of theory and practice. This will become evident in the following chapters, where I describe the evolution of my projects during this PhD. The culminating topology as a strange loop (compare What Is Play? (p. 15)) is revealed in section Theory vs. Practice (p. 149) by reflecting on this distinction. The two initial sources of inspiration for framing my own practice are the topic of the next section.

1.10 Mateas and Schwab: Artistic Research

In section Von Foerster: Second Order Cybernetics (p. 29), I have characterised cybernetics as a field encompassing both theories and practice, with many of the protagonists working on both sides of this distinction. This mode of knowledge production is echoed in my own *research informed practice / practice informed research*, which is inspired in particular by two approaches: Michael Matejas’ expressive AI and Michael Schwab’s *Exposition of Artistic Research (EAR)*.

According to Mateas, the practice-based method is different both from the classical

scientific methods and from the arts, yet it is informed by both areas. He calls his methodology “expressive AI”, noticing that “AI-based art is not a subfield of AI, nor affiliated with any particular technical school within AI, nor an application of AI. Rather it is a stance or viewpoint from which all of AI is reconstructed” (Mateas 2001, p. 4).

Constructive, performative and transformative qualities are in stark contrast to the focus on task competence in the AI mainstream that rooted in computer science and engineering (Hernández-Orallo 2014). I am embracing and extending Mateas’ approach by adding three points to it. First, in my investigation I open up the topic from AI to an exploration of playful systems, which includes observations about artificial intelligence, in particular in chapter Human vs. Machine (p. 97) and through my project *KlingKlangKlong* (see Project: KlingKlangKlong (p. 110)). The second addition is to break up the dichotomy between arts and sciences and to replace it with a transdisciplinary approach that includes and transcends a wider range of disciplines including contributions from the humanities (compare Requirements for a New Paradigm (p. 24)).

Thirdly, Mateas reveals a quite conservative attitude towards art: “If the audience is able to participate in the poetics defined by the artist, [. . .] then the piece is successful” (Mateas 2001, p. 3). I contend that in post-modern times, criteria for “successful” art cannot deny anymore to acknowledge art as an autopoietic system (Luhmann 2000). This is further discussed in sections Games vs. Art (p. 63) and Game AI vs. Playing Machines (p. 106). It also leads to a second practice-based inspiration for my project.

Michael Schwab, who established the Journal for Artistic Research (JAR) (Schwab 2011) and the associated Research Catalogue (RC), has proposed exposition as a mode of artistic research. This methodology is based on the concept of “expositions” – in particular online objects admitted into the catalogue “that are meant to expose practice as research” (Schwab and Borgdorff 2014, p. 92). The procedures described for exposition require elaborate considerations, for example, the distinction between simple media and works (Schwab and Borgdorff 2014, p. 94-97).

As with Mateas’ approach above, I have adapted and appropriated the concept by including expositions in any form and medium that are meant to expose practice as research. Each of the eight projects included in this thesis (see Project: Hostile Environment Facility Training (p. 40), Project: Spiel 1 (p. 57), Project: Imperfect VR (p. 74), Project: Neurotic (p. 100), Project: KlingKlangKlong (p. 110), Project: CO2rnwall CO2 Challenge (p. 130),

Project: Pedestrian Fitness Initiative for Plymouth (p. 135) and Project: Speed Gardening Guerrilla (p. 138)) have gone through an instance of exposition, the majority of them multiple times. The forms and places of exposition, however, have varied extensively: from an art gallery in London to the streets of Krakow and from various university workshop rooms to a play festival in Siegen, as documented in the respective sections. I have been constantly iterating the exposition of my research and research through exposition while moving through my project.

I will continue to reflect on the distinction of theory versus practice in section Towards Play Design as Research (p. 154). First let me dive into the practice of distinctions by looking at an example of a project that is based on the distinction between distinction and identity.

1.11 Project: Hostile Environment Facility Training

"Since 2012, the Government has established its "hostile environment" policy, affecting the lives of hundreds of thousands of people, so-called "legal" and "illegal" immigrants, refugees and British citizens.

We believe that hostile environments are for everyone. We all can be a bit more hostile."

(Straeubig 2018b)

The *Hostile Environment Facility Training (HEFT)* (Straeubig 2018a) is a fictional training event that takes part in a bland room furnished with tactical vests, flood lights, barbed wire, metal barriers and surveillance cameras. The room is initially dark except for a glowing button located on a plinth.

To start the training, visitors have to press the button. This triggers a sequence of three short instruction videos projected against a wall of the room. The videos feature two unspecified officials, "Agent A" and "Agent B", that present exercises for creating hostile environments. The goal of the first exercise is to practice hostility veiled in politeness. Players are encouraged to apologise by saying "sorry", but not meaning it. This is demonstrated by one of agents first yelling at the other one, then half-heartedly apologising in a passive-aggressive manner. In the second video, players are instructed to march, which is also demonstrated by the agents. In Foucault's description, marching, understood as communication, constitutes "a bodily rhetoric of honour", the body as a signifier of

power yet at the same time docile and to be formed (Foucault 1995, p. 135-136). The final exercise consists of rearranging the metal barriers in the room in order to keep some unspecified “others” out. This video then descends into slapstick, with a sequence of still images depicting both agents toying in various poses with the metal barriers.

After each video, the floodlights switch on automatically, bathing the room in harsh light, while elevator music (Lanza 2004) plays. These breaks are supposed to give the audience the opportunity to practice their own hostility, based on the training instructions received in the video. At the end the floodlights switch off again and the room returns to a dark and quiet state, waiting to be activated by the next player.

During one iteration of *HEFT*, which takes about 15 minutes, the flood-lighted room, the uniformed agents, the props as symbols of surveillance and exclusion and the physicality of marching and rearranging the barriers in a tight space are designed to create a form of playful unease. This is juxtaposed by the ironic affirmation of hostility, some over-the-top acting and the elevator music playing during the training.

1.11.1 Development

I developed the concept of *HEFT* based on discussions at the *Playbour: Work, Pleasure, Survival* co-creation workshop held in London in April 2018 organized by Dani Admiss and Ruth Catlow (Straeubig 2018a). In the workshop we had touched on different aspects of the distinction between play and labour (see *Play vs. Work* (p. 51)). One of the topics revolved around ways to create playful artistic responses to government policies such as the “hostile environment” policy, announced under Home Secretary Theresa May in 2012 (*A Guide to the Hostile Environment* 2018).

HEFT was then commissioned by the curators Dani Admiss and Ruth Catlow and developed by me as an interactive piece for Furtherfield Gallery, an art exhibition space located in Finsbury Park, London. I chose to pursue the topic of hostile environments further by elaborating on the idea of an affirmative stance towards hostility. I wrote and designed the piece, designed the room, wrote the film scripts, played one of the agents, and programmed the logic to control video and floodlights via wireless sockets on a Raspberri Pi microcomputer.

Originally, I had planned to fabricate the props, including a metal detector acting as a symbol for a hostile/controlled passage, in cardboard material. Then I discovered during

my research that the entrance of Banksy's event space *Dismaland* had been styled in exactly the manner that I had envisioned (Banksy 2015). To avoid the impression of having copied from that work, I discarded the initial concept and went on with genuine materials (omitting the metal detector for budget reasons). Nevertheless, *Dismaland* was a major inspiration. Even from the distance of available documentation, e.g. (Cawston, Manco, and Cockshaw 2016), the aesthetic and atmosphere portrayed by performers and facilities at *Dismaland* has been radiating the “playful unease” that I was aiming for.

1.11.2 Exposition



Figure 1.1: Hostile Environment Facility Training video

Furtherfield Gallery, London presented *HEFT* as part of the exhibition “Playbour — Work, Pleasure, Survival” on six consecutive weekends in July and August 2018. A private view was held on July 13, 2018.

1.11.3 Discussion

In *Hostile Environment Facility Training*, the player is given the task to practice the creation of their own personal hostile environments. The piece therefore frames hostility from



Figure 1.2: Hostile Environment Facility Training at Furtherfield Gallery

a first person view instead of empathising with the victims of these policies (compare *Exploring the Virtual* (p. 91)). Through this reversal of perspectives and with an over-the-top affirmation of hostility, I aim to create a space for the players to reflect on their own emotions and on their personal interpretations of the phenomenon of hostility.

The term “hostile environment” invites a literal reading of the project as being concerned with the distinction between system and environment (*System vs. Environment* (p. 123)). And indeed it represents a critique of the eponymous government policies that comprise a wide range of measures designed to deter “illegal immigrants” by limiting or denying access to services concerning schooling, higher education, health system, banking, housing, social support and employment. Home secretary Theresa May declared in 2012 that the rationale behind the policy is “The aim is to create, here in Britain, a really hostile environment for illegal immigrants” (Kirkup and Winnett 2012).

The keenness and a passion for detail of the bureaucratic efforts appear remarkable — even obtaining a driving license was made more difficult, and new criminal offences, including “illegal working” were introduced (Taylor 2018). Moreover, according to the National Council for Civil Liberties *A Guide to the Hostile Environment* (2018), elaborate

systems of spying, detention and deportations were put into action in various branches of the administration.

However, one of my motivations behind this work comes from a more personal direction. The themes of *Hostile Environment Facility Training (HEFT)* are an attempt to reflect on my own observations about cultural manners, expected behaviour and the experience of a deteriorating political climate in the UK. They come from personal impressions as an immigrant, amplified by the United Kingdom European Union membership referendum in 2016. Thus, the question of distinction vs. identity (see *Distinction vs. Identity* (p. 15)) develops another meaning, one that is rather personal and less abstract.

In this interpretation, identity is related to a desire for homogeneity and attempts at exclusion whereas playing with distinctions presents the opportunity to cross boundaries freely, observe what is on the other side and possibly return to the previous territory along with new insight. In this sense, I understand *HEFT* as a political commentary, one that celebrates distinctions and diversity, although in the mode of satire and dark play (see *Play vs. Dark Play* (p. 67)). The distinction between identity and distinction, introduced by theory in section *Spencer Brown: Draw a Distinction* (p. 28) receives a concrete, personal, political form. Referring to Foucault, one could call the hostile environment a prison, solely created to discipline and punish (Foucault 1995), referring to Goffmann, a case of spoiled identity, stigmata created through hostile exclusion (Goffman 1990a).

These aspects are complemented by inspiration from artworks that went into the narration, aesthetics and design for the performance. *Papers, Please* by Lucas Pope (2013) is a game where the player finds herself in the situation of an immigration officer, balancing necessities of daily life with decisions about approval or rejection. The game is cast in a retro-cartoon style that catches the atmosphere of the former Iron Curtain. Other influences came from the bleak, reduced stage design of Lars von Trier's *Dogville* (von Trier 2003) and from the over-the-top acting and outfit of Machina Ex's *Right of Passage* (machina Ex 2015), a participatory live performance that lets inhabitants, wardens and bureaucrats collide with each other in a fictional refugee camp.

During my research, I used pictures of border agents, fortifications and other examples of hostile design and defensive architecture. These concepts predominantly denote the implementation of a range of measures to drive away homeless and other unwanted people. This includes the rigorous enforcement of zoning laws, classical music in underground

stations, slanted and separated benches in parks and at bus stops, structures to prevent locking bicycles, metal grids covering ventilation shafts and spikes installed in pavements.

“While some forms of defensive architecture forcibly exclude street homeless people [...] others employ milder techniques of physical or auditory manipulation to render particular spaces less ‘attractive’” (Johnsen, Fitzpatrick, and Watts 2018, p. 1117).

Artists have engaged in critical responses to these phenomena, including the documentation *silent agents* by Julius-Christian Schreiner (2018) and the installation *Labyrinths* by Jason Wee (2017), that presents crowd-control barriers in cultural contexts (Comaroff 2017). Lorenzo Pezzani, a practice-based researcher of cross-Mediterranean migration, asserts that “the process of making (mainly urban) space unliveable for some bears an eerie resemblance with the ways in which other, more ‘natural’ environments have been turned into spaces of hostility for migrants” (Pezzani 2018). Pezzani understands the concept of the hostile environment as being extended to geopolitical dimensions.

By contrast, the small room in which *HEFT* takes place is designed as a playful interactive hostile environment, with glaring halogen lights, muzak and the props that are present in the room: (fake) surveillance cameras, metal barriers, barbed wire and tactical vests. Every prop is provided both as a tool and as a toy: a tool in the context of visitors being compliant with the instructions given in the videos, and a toy, because they are actually free to use the props in any way they like, with no actual surveillance present.

As an interactive experience, by and large the idea to design for affordances is a guiding consideration (Gibson 1977). As I discovered during the making of this project, this can turn out to be difficult in practice. The room features vests that can be put on, and most crucially the players have to start the experience by pressing the illuminated button. As I was present at the private view and at some occasions during the exhibition, I could observe visitors that were waiting patiently in the dark for something to happen — the glowing button was not recognised as an invitation to press it. In this case the intended transformation from an art space (located within an actual hostile environment) into a (fictional) hostile environment training centre could not take place without interference from the artist (compare Actual vs. Potential (p. 83) and Virtual vs. Fictional (p. 84)).

By taking the site of the installation into consideration, a different system vs. environment reference can be observed. Furtherfield Gallery is located in Finsbury Park, and the immediate vicinity is home for many rough sleepers. The park also hosts vast commercial

events during which large parts of it are cordoned off, with the same sort of crowd control barriers that I used in the piece, private security staff and drug-sniffing dogs. This also occurred during the preparations of *HEFT*, which provided a surreal, hostile environment around the location of my playful one.

In the final shot of training videos, the audience is addressed again: “Now it’s your turn”. The experience itself does not offer further explanations but leaves its interpretation open to the players. Both as a game and in a political context, maybe the only winning move is refusal: not to play along with the instructions or not to play at all (see Discussion (p. 59)).

1.12 Summary: Puzzling

In this chapter I have introduced a particular methodology: observing play through distinctions. I have postulated seven requirements for a comprehensive description of play and laid out an appropriate theoretical background rooted in specific cybernetic, constructivist, systems-theoretic and practice-based theories and traditions. I have also illustrated the fundamental distinction between distinction and identity through my project *Hostile Environment Facility Training* that plays ironically with the notion of identity.

Now I am able to arrange the individual puzzle pieces described in this chapter that make up my methodology: Spencer-Brown contributes distinctions as a fundamental methodology, second-order cybernetics supplies a high level of abstraction, the idea of observers¹⁷ and von Foerster’s ethical imperative, and Maturana and Varela introduce systems that reproduce their own elements. From radical constructivism I take the idea that knowledge is constructed, and from Papert’s constructionism that this involves creating objects to think with: these are my projects, concrete, specific counterweights to abstraction. Luhmann provides the extension to social systems as systems of communication that are to be distinguished from minds and biological systems. Andersen and Stott have applied similar systems-theoretic ideas to management games and performance. Mateas and Brooks demand new approaches to AI, while Pickering fuses ontology and performativity. And Schwab constitutes exposition as an empirical method in artistic research.

In the remaining chapters of this thesis, I will put these puzzle pieces together into an

¹⁷Sutton-Smith (1997) is already observing observers through the lens of rhetorics (intentions); therefore I am sometimes observing an observer observing observers, a complex matter indeed as indicated above. With the methodology discussed throughout this chapter, however, I believe that this kind of complexity can be rigorously described.

epistemological tool to observe both play and the pieces themselves. It is then possible to examine their fitness towards fulfilling the requirements stated in section Requirements for a New Paradigm (p. 24). With these fundamentals in place, the initial question about play can be asked again. So let me start anew and draw a distinction.

Chapter 2

Play vs. Non-Play

What we are moving into is [...] the Ludic Century, an age that is characterized by play.

Eric Zimmerman (2011)

2.1 Da Capo: What Is Play?

In the previous chapter, I have brought up the problem of play as a problem caused by definitory approaches. This was highlighted by the two incommensurable positions of Sutton-Smith (1997) and Burghardt (2005a).

With the conceptual framework of distinctions and higher order observers established, it is now possible to describe Sutton-Smith and Burghardt as representatives of the different ways that social and natural sciences observe, one through explanations, the other through descriptions (Seiffert and Radnitzky 1989). More precisely, Burghardt's position appears within Sutton-Smith's rhetoric of progress (compare What Is Play? (p. 15)), while from Burghardt's perspective, Sutton-Smith's ambiguity cannot provide a definition (see Definitions vs. Distinctions: What Is "Is"? (p. 23)). Both positions appear in a deadlock.

Sutton-Smith's description of rhetorics as vehicles of persuasion (echoed by Ian Bogost for the medium of video games (Bogost 2010)) is nothing but the introduction of observers (compare Von Foerster: Second Order Cybernetics (p. 29)), although in an unnecessarily implicit and abstract manner. From the postulate of observers it follows that Burghardt's goal cannot be fulfilled; there cannot be a neutral standpoint, from which someone would be able to state the objective meaning of play. With Schulz von Thun (1981) every act

of communication can be construed as a rhetoric in Sutton-Smith's sense, as it always has a persuasive component: the sender is in some way appealing to the receiver of the communicative act.

Instead of separating play from non-play by definitory boundaries we can now start looking at distinctions between play and different forms of non-play and cross these distinctions freely. Before I do that I want to mention an attempt to remedy the situation depicted in section What Is Play? (p. 15) suggested by Thomas Henricks (2008). He interrogates play through a number of questions about its nature, moral stance, functionality, rationality and finally about the degree of freedom in play compared to other human activities. Pursuing these queries, he arrives at a proposed classification for the wide variety of meanings attributed to "play" (Henricks 2008):

- Play as a certain activity
- Play as a pattern of behaviour
- Play as a spirit towards a behaviour (playfulness)
- Play as an individual action
- Play as a pattern of interaction between multiple players
- Play as quality of experience

While this kind of analysis can be considered useful to sort the various definitions and explanations into different categories, Henricks' underlying philosophy remains within a general framework of identity. He also starts with the question "What is play?" followed by a collection of contradicting and incommensurable answers (compare What Is Play?). Like Sutton-Smith, Hendricks has to resort to a method that paradoxically leads to fragmentation and division. Henricks attempts to deal with this ambiguity by "celebrating this diversity" of the concept, yet he believes "that the differences between contemporary treatments of play are perhaps not as great as they appear and that a more unified or integrated view of play is possible" (Henricks 2008, p. 176).

Rather than challenging this view, I argue that pursuing essentialist accounts of play is not a desirable endeavour in itself. Such a reductive approach can only succeed by eliminating the diversity of positions brought forward by different observers. Burghardt's way of

insisting to resolve conflicting accounts of play by definition is paradigmatic for scientific approaches.¹ In contrast, I will pursue the goal of observing play from a multitude of perspectives. According to Heinz von Foerster's ethical imperative (compare Von Foerster: Second Order Cybernetics (p. 29)), increasing the number of choices creates variety. In order to acknowledge diversity, instead of reducing the number of possibilities, we must allow different voices.

In the next sections I am following Spencer-Brown's imperative (see Spencer Brown: Draw a Distinction (p. 28)) to observe the phenomenological landscape of play, as well as other observers, through the lens of distinctions. As postulated in (Spencer-Brown 2008), to set the procedure into motion it is necessary to draw an initial distinction and then continue from there.

2.2 Play vs. Work

In the introduction to this thesis, I have outlined the personal background behind my research (see The Cold War (p. 1)). In particular, I have depicted my failure to comprehend the idea of work, which set my motivation for the initial distinction. I will therefore start this chapter with the distinction between play and work². To observe this particular distinction, I begin on the side of play. There are many, but not arbitrarily, many possibilities to continue in a meaningful way. Here I choose to revisit Huizinga's definition of play, discussed in section Discussion (p. 114): "Play is a voluntary activity or occupation executed within certain fixed limits of time and place, according to rules freely accepted but absolutely binding, having its aim in itself and accompanied by a feeling of tension, joy and the consciousness that it is 'different' from ordinary life" (Huizinga 1955, p. 28).

With these observations in mind there are different options: One is to query Huizinga's characteristics in turn and notice, for example, that people do work voluntarily. This means, the voluntary quality of play cannot be a sufficient condition. But is it a necessary one? By crossing the play vs. work distinction we then can continue with the discussion of Marx's concept of work or the practices of forced labor and slavery (Komlosy 2018). Yet other approaches to work are available that characterize it in a purposeful and fulfilling manner (Whitmyer 1994).

¹I will return to discuss disciplinary contexts in section Play and Discipline(s) (p. 151).

²See Discussion (p. 114) for a discussion about the (non-)relevance of order with regard to observing distinctions.

I want to come back to the initial question: How can we characterise play as opposed to work? Is there a distinction that demarcates the territory of play from the territory of work, however complex and convoluted this boundary may be? As an example, what is the situation of a professional chess player who is taking part in a tournament? The tournament comes with prize money, and the player earns their living from this income. Is she playing or working during the matches of the tournament? If the presence of money implies that she is working, neither gambling nor any sports event with some form of remuneration would be considered as play (Schwartz 2007). There are games like poker that are commonly played for money, a game that I would consider being lacking in excitement without the added thrill of stakes. I also claim that this cannot be said about chess. On the other hand, if the professional is indeed playing, that would mean that play cannot be defined by the absence of external rewards. Professional acting, sports and e-sports, commercial streaming, taking part in game shows and various forms of playbour (see below). There are numerous examples where the act of playing itself is being remunerated.

Conversely, the absence of payment in exchange for an activity does not necessarily indicate play. I have mentioned forced labour above. Other counterexamples include work therapy in psychiatric hospitals, volunteering and the vast area of unwaged labour, so-called “house-work”, often carried out by women, that was rendered invisible by the codification of work in the 19th century (Komlosy 2018).

From this discussion it becomes apparent that rather than viewing monetary reward as a criterion of play vs. non-play, it could make sense to introduce the distinction between paid play vs. unpaid play. This would create a new pair of categories, however, and we would then be faced with the same kind of challenge: to define and describe what constitutes the difference between them. In other words we would be developing a taxonomy. As described in section Von Foerster: Second Order Cybernetics (p. 29), there is another approach available, and that is to take the observer into consideration. Then the apparent paradox vanishes. The taxation of the chess player’s prize money defines the activity as work, while the chess player might experience pure play.

This analysis requires a second order observer who observes the other observers and their respective system references. The distinction is not between paid vs. unpaid activity but between work observed by the economic and political system vs. the intrinsic experience

of the player. Both observers, tax authority and player, can insist on apparently conflicting observations as long as their system references are kept intact. Otherwise, a conflict arises if the tax collector tries to convince the player that her interaction during the tournament has to feel like work or if the player maintains that she shouldn't be paying taxes justified by her personal play experience.

I contend that this approach would help to clarify some of the misunderstandings that are currently present in situations where work and play interfere. Phenomena such as Gamification, the application of game elements in non-game contexts (Deterding et al. 2011) have raised fierce controversies, with proponents (McGonigal 2012; Werbach and Hunter 2012) and critics (Bogost 2011) alike. A point of critique is that gamification obviously serves external purposes (Llagostera 2012). Does this mean that game elements become ethically tainted in non-game contexts? A greater diversity of second-order observers seems to be helpful in order to gain a deeper understanding of the debate (Fuchs et al. 2014; Fizek 2016).

A related yet different concept is called "playbour" and it takes a more critical position towards the distinction between play and labour. Its origin are observations of a largely non-commercial and voluntary game modification ("modding") scene being commodified by the games industry (Kücklich 2005). With gig economies on the rise, digitized service brokering growing and work relationships being fundamentally re-defined, various new forms of precarious digital labour are developing (Scholz 2013). In the context of virtual worlds such as *World of Warcraft* (Blizzard Entertainment 2004) a new proletariat of "work-players" are providing services for other players (Nakamura 2009).

"The supreme accomplishment is to blur the line between work and play" is a quote ascribed to the British historian Arnold J. Toynbee by Langer (2014, p. 133). In contrast, I am asking what conclusions can be drawn from looking more precisely at the play vs. work distinction? I see confirmation for my thesis that neither play nor work can be defined. Therefore classical approaches such as Huizinga's or Caillois' descriptions (compare *What Is Play?* (p. 15)) are not sufficient to make sense of phenomena such as gamification and playbour. Perhaps this is also due to the specificity of the distinction. It is then helpful to

discuss a more general question: does play have any purpose at all?

2.3 Play vs. Purpose

Bernhard Suits' answer to this question is affirmative. He claims that any activities without a purpose would constitute random movements (Suits 1978, p. 91). Play isn't random, and therefore it must have a purpose, Suits concludes. If we accept this premise, then the question is how purpose and play relate to each other.

As Johan Huizinga (1955, p. 2) notes, many theories about play share the commonality that "play must serve something which is not play, that it must have some kind of biological purpose". The question arises whether a purpose is an intrinsic quality of play or rather an artefact of the observer (compare Von Foerster: Second Order Cybernetics (p. 29), Reality vs. Truth (p. 88) and Play and Discipline(s) (p. 151)). Drawing attention to games of chance in particular, Caillois characterises these kinds of play as unproductive and in a literal sense uncreative: "Property is exchanged but no goods are produced" (Caillois 1961, p. 5). This can be read as a description of capitalism, where the accumulation of profit has decoupled from the creation of goods and services (Chang 2011, p. 231-241). Drawing a distinction between betting and gambling on the one hand (Schwartz 2007) and speculation with volatile financial instruments like stocks, options and futures on the other reveals common phenomena (Grall-Bronnec et al. 2017; Shin et al. 2015) as well as common traits in the players (Jadlow and Mowen 2010). However, capitalism asserts that money in itself is not without purpose (Durand 2017). As a game element that adds an external purpose, money therefore allows players to avoid the *horror vacui* of frivolous idling.³

Burghardt (2010, p. 10) calls play "seemingly purposeless behaviour that is enjoyable". This point of view shows that in order for science to observe phenomena such as play, games and art (see Games vs. Art (p. 63)), it becomes necessary to introduce a distinction between intrinsic and extrinsic purpose, which relates to the epistemological gap between the first person and third person perspective (compare Paradoxa of Play (p. 69)). For Burghardt, play must appear "seemingly" purposeless, because natural and social sciences observe behaviour with the a priori assumption of some purpose. This

³In Luhmann's theory, money has a communicative function. It represents a symbolically generalised medium of communication, allowing payments and prices to universally signal value expectations (Luhmann 2008).

becomes apparent through Tinbergen's four questions (Tinbergen 1963), paraphrased as follows: "What is it for? How does it work? How did it develop (ontogenesis)? How did it evolve (phylogenesis)?" (Bateson and Laland 2013).

I have asked, if play could not have any purpose at all (Straeubig, Hsu, et al. 2016). This question distinguishes two distinctions: intrinsic vs. extrinsic purpose and autotelic vs. heterotelic behaviour. Autotelic activities, a concept developed by Csikszentmihalyi in the context of research on flow (see Presence vs. Immersion (p. 127)), are activities that are done for their own sake (Csikszentmihalyi 1997, p. 117).

Not only play but contemporary art have been characterised as autotelic (compare Games vs. Art (p. 63)), which does not sit well with some ethical positions. "Don't waste your time" is not only the mantra of concerned parents directed at their video game playing children, but also advice from stoic philosopher Seneca (2004). This assumes a view of life that is obliged to focus on outcomes, in form of the doctrines of utilitarianism or protestant work ethics that have been first amplified and then superseded by industrialisation (Komlosy 2018). However, not everyone is convinced of the utilitarian prerogative, as Nietzsche famously quibbled: "If you have your why? for life, then you can get along with almost any how? Man does not strive for happiness; only the English do that" (Nietzsche 2008, p. 6).

Kršiak notes that in the light of "biologically non-purposeful" activities, extensions to ethological models are required in order to adequately describe humans (Kršiak 2011). Bateson and Martin (2013, p. 13) propose to draw a distinction between the broad biological category of play and what he calls "playful play". This aggregates two distinctions that I have introduced earlier, psychic vs. social systems (see Luhmann: Distinctions Create Meaning (p. 33)) and first person vs. third person perspective (see Requirements for a New Paradigm (p. 24)).

This combination implies that in order to observe playfulness, I have in principle two choices: I can experience it myself, by joyfully playing or by creating playful experiences, where I am playing throughout the process of making as well. This is the immediate, privileged access of the first person perspective. The second option is to observe others and to make sense about *their* inner experience, moods, and feelings while they play (compare Play and Discipline(s) (p. 151)). One may measure the flow states of players (Chen 2007; Nacke and Lindley 2008) or examine the clinical potential of virtual reality (Riva, Wiederhold, and Mantovani 2019). In these cases, the third person perspective

involves biological or social systems and the immediate access to the phenomenon of play is lost. Developers interested in creating — in the double meaning of the word — rewarding experiences are increasingly adopting scientific research in their game design methods (Sherry et al. 2006; Rigby and Ryan 2007; Przybylski, Rigby, and Ryan 2010; Koster 2013; Lankoski and Holopainen 2017). On the other hand there are artistic responses that critique that telos of utility. Brian Schrank (2010) shows that various projects such as *Space Giraffe* by Jeff Minter (2007), *Untitled Game* by Jodi (1996–2001) or Farbs' *ROM CHECK FAIL* (Farbs 2008) have critiqued the doctrine of play as a pleasant experience with humour and deconstruction. In response to Bateson and Martin (2013) and Suits (1978), I conclude that play does not necessarily carry lusory attitude, joy or positive mood as a purpose (see also Play vs. Dark Play (p. 67)).

Proponents of play go further by crossing the theory vs. practice distinction and practicing play for its own sake. For example, the *New Games* movement has promoted, designed, collected, staged and published a wide range of inclusive, experimental and adventurous games and playful experiences, challenging existing concepts about play. *New Games* were promoting cooperative, non-competitive principles as well as playful competition, represented in the slogan on the cover of (Fluegelman 1976): “Play Hard. Play fair. Nobody hurt”. Bernie De Koven, one of the main figures of *New Games* has continued this “playful path” all his life and inspired countless others on the way (DeKoven 2013; DeKoven 2014).

A counterpoint to the idea of frivolous play are serious games, activities that add an external purpose to game mechanics (Dörner et al. 2018). Often the envisaged benefit of a serious game is learning (see next section). My project *Spiel 1* (see Project: *Spiel 1* (p. 57)) is a light-hearted take on serious games for peace education (Wulf 1973), whereas documentary filmmaker Harun Farocki has investigated the outright brutal reality of game technology in the context of military training and operations (Farocki 2009; Farocki 2010c; Farocki 2010b; Farocki 2010a).

2.4 Play vs. Learning

In the concept of learning, the two distinctions play vs. purpose and playful vs. serious intersect. It is often understood as a central purpose of play (Sutton-Smith 1979). Sutton-Smith (1997) also refers to learning as the “rhetoric of progress” (compare What Is Play? (p. 15)). This rhetoric branches out in two directions which both share the assumption

of purpose (see Play vs. Purpose (p. 54)). One leads into the dark side of play, where playing violent video games is a detriment to players' minds (see Play vs. Dark Play (p. 67)). The other position is affirmative towards play and stresses its importance for learning. This sentiment, developed by eminent learning theorists like Johann Heinrich Pestalozzi, Maria Montessori and Jean Piaget is shared today by a host of researchers of pedagogy and creativity alike (Bateson and Martin 2013; Bateson 2015; Sawyer 2003).

For the case of animal play, ethologists observe learning as the purpose for a wide variety of play behaviour (Bekoff 1998). Two of the learning theories that were historically proposed (Groos 1898), namely motor training and preparation for future unexpected situations, have been substantiated experimentally (Pellis, Pellis, and Bell 2010). Even machines are increasingly playing to adopt new behaviours (see Game AI vs. Playing Machines (p. 106)). I want to caution against assumptions of causality between play and learning. There is a wide range of empirically validated learning methods ranging from rote repetition to constructivist and situated approaches (Stewart 2012). Therefore, learning does not necessarily have to be a purpose of play, despite observations that the two phenomena are correlated.

In the previous sections I have offered my critique towards promises and expectations of infusing play with external, in particular educational purposes that are blurring the distinction between play and non-play. In the next section I will continue this discussion through my practice in the form of a fake peace education game — *Spiel 1*. Wulf (1973) describes peace education as an attempt to analyse, discuss and overcome different forms of violence and lack of peacefulness. These games have received surprisingly critical reactions; Warwitz and Rudolf (2016) for example lists peace games along with war games and malicious games under the “controversial games” category. What makes games that promote the ideal of peace controversial?

2.5 Project: Spiel 1

Spiel 1 (“Game 1”) is a performance that interrogates the distinction between play and non-play. It is arranged as an encounter between a purported scientist and an audience member, who is subject to a fictional experiment for the purpose of peace education. The setup consists of a table with two chairs. On the table is a laptop which is connected to a brain-computer interface (BCI) and to a toy device that resembles a rocket launcher and

is capable to fire off foam projectiles. A few meters apart, a teddy bear is shackled to a scaffold, within the target range of the rockets.

The performer, usually wearing a white lab coat, introduces the experience as a “serious game for peace education”. The participant is then fitted with the BCI headset and is advised to “think peacefully” for a timespan of about a minute while the device is analysing their brainwaves. It is explained to them that in the event that “non-peaceful” thoughts are detected, the rockets will be launched at the stuffed animal.

During the interaction which goes through ritualised stages — greeting the participant, cleaning the headset, calibrating the device and conducting the “experiment” — the performer engages in conversations about the participant’s emotions, aggressive tendencies and politics of war and peace. The mechanism, as described below, allows the performer and the participant to watch a representation of biosignals taken from brain and muscular activity in real time. In some of the encounters, the apparatus fires off the rockets while in other cases the calamity for the toy is avoided. An interaction takes about 20 minutes.

2.5.1 Development

The physical setup of *Spiel 1* consists of four components. The Neural Impulse Actuator (NIA), manufactured by OCZ Technology, is an early consumer grade brain-computer interface (BCI). It features a headband with 3 channels that measure EEG signals from dry electrodes on the forehead. The NIA was developed to serve as a game controller in order to facilitate faster responses to the stimuli. The rocket thrower is an USB-connected device that can be triggered by sending a particular command. A laptop running the software and the teddy bear fixed to a contraption complete the setup.

The BCI device transmits various bio-potentials including alpha and beta brain waves, as well as facial and ocular muscle impulses that are sampled, filtered and divided into several frequency bands to the host computer. These can then be further analysed as values over time and — after a Fast Fourier transformation — as a spectrum of frequencies. Both the frequency distribution and intensity of the signal can be used for analysis and detection of emotional states, which is an active area of research and experimentation (Prpa and Pasquier 2019).

I have developed the software based on an open source USB interface written in Python by Mershon and Ng (2013). In *Spiel 1* the incoming signal is used to trigger the firing of

the rockets based on the difference between a baseline measurement that is taken in the first few seconds of the encounter and a running average taken during the remainder of the interaction. The mechanism has an adjustable threshold. It also allows the triggering of the rockets manually, in case the performer decides to do so for dramatic reasons.

2.5.2 Exposition



Figure 2.1: Spiel 1 at the Glockenspielstrasse theatre event

I developed *Spiel 1* for the fringe theatre event Glockenspielstrasse that took place in Erlangen, Germany in June 2013 (Straeubig 2013c). The performer was Stefanie Heublein. In April 2015, I staged *Spiel 1* at the playin' Siegen festival in Siegen, Germany. For this occasion I revised the code base and also acted as the performer.

2.5.3 Discussion

When I created *Spiel 1*, my major intention was to interrogate the distinction between serious games and games in a playful and ironical manner. Whereas the setup and the purported purpose of peace education are fictional, the interaction pretends to be serious and aims to keep the (dis-)belief of participants in suspense. While navigating the boundaries between serious and non-serious play, both the theme of peace education and the technical implementation of *Spiel 1* are grounded in realism. As mentioned earlier,



Figure 2.2: The target of missile strikes in Spiel 1

the use of games for peace education was met with irritation (see Play vs. Learning (p. 56)). The intermixture of play and external purposes raises questions about the interests or intentions of the system introducing the purpose (see Play vs. Purpose (p. 54)).

Spiel 1 can also be understood as a playful critique of the use of Brain-Computer Interfaces for artistic purposes. The term Brain-Computer Interface denotes a noninvasive technology to measure and record brain activity to control a machine (Wolpaw et al. 2000). A BCI registers potential differences from the scalp caused by electric activity of neural ensembles (Nicoletis and Lebedev 2009).

The implementation of a BCI includes components for signal acquisition, amplification, feature extraction and classification and translation into signals for a control interface (Mason and Birch 2003). BCI are used in clinical applications and increasingly in consumer settings such as neurofeedback (Marzbani, Marateb, and Mansourian 2016).

Using EEG measurements in performative and artistic settings has a long tradition, reaching back to Alvin Lucier's *Music for Solo Performer* (Lucier 1965). Jacqueline Humbert (1974) demonstrated with *Brainwave Etch a Sketch* how brain signals from two people could generate drawings on a screen. At documenta 14, Janine Antoni presented the performance *Slumber*, where she had an EEG recording her brain waves during sleep.

She then wove the readings into the blanket under which she slept (Antoni 1994). *Brain Study* by the art collective a rose is uses networked BCI to create music (A rose is 2001).

Expo 2000, the world fair taking place in Hannover saw the project *Brainball* by the Swedish Interactive Institute (Interactive Institute 2000). The setup consists of two players who are sitting on opposite sides of a table. Both player wear Brain-Computer Interfaces and a ball is moved by a magnetic contraption towards the player that exhibits the more excited state, therefore asking the players to stay calm. This design subverts the usual characteristic of a game as an activity (compare Da Capo: What Is Play? (p. 49)). “Brainball can best be described as an anti-game. In most games success is achieved as a result of activity, decision-making, and physical coordination. In Brainball none of these capabilities counts. Here the goal of the players is to achieve—nothing” (Hjelm 2003, p. 29).

With a surge of consumer grade BCI devices since the 2010s, access for artists has become easier, which has led to a proliferation of “brain art” (Nijholt 2019). However, uncritical artistic use of this technology comes with some caveats. While EEG measurements in clinical contexts have to follow strict protocols that strive to ensure that there is a minimum of noise in the data, artists that use consumer-grade BCI devices outside laboratory conditions are prone to measure environmental artefacts and a mixture of biological signals (Samek and Muller 2015).

Other than deliberate applications of noise as a medium for aesthetic disturbances (Prior 2015), neglecting its role as a confounder in brain art risks mirroring the commercial marketing of biofeedback products by a growing learning and wellness industry. In this critique, I am crossing distinctions between science, art and economic systems where artistic claims, scientific results and commercialization interfere. A comprehensive understanding of society as a system of systems may provide orientation in these complex situations (Luhmann 2012, p. 1-112).

Where art meets science there are not only potentials for misunderstanding but also opportunities for creation. David Rosenboom, a pioneer of early artistic experiments with biofeedback (Rosenboom 1976), writes about the excitement of these encounters: “Thus, I want to make all the juxtapositions I can between technology and nature. To confront the scientist and artist with each other” (Rosenboom 1970, p. 56). Rosenboom is further citing the cybernetic and cultural developments that are taking place at that time and concludes “that it is necessary for us to develop new ways of looking at systems”

(Rosenboom 1970, p. 56). I argue that this development has taken place, with radical constructivism, second-order cybernetics and in particular with Luhmann's systems theory, and that *Spiel 1*, in its mischievous manner, is drawing attention to distinctions between artistic and scientific observations (see Distinction vs. Identity (p. 15)). Borck (2018) reminds us that the "electrical brain"⁴ has not only a scientific but also a cultural history, one that observes the way scientists observe the brain. In Kittler's words, these brains constitute discourse networks, "technologies and institutions that allow a given culture to select, store, and process relevant data" (Kittler 1990, p. 369).

The way I chose to deal with these conceptual challenges was to avoid claims of serious significance, let alone of scientific validity of the BCI readings taken in *Spiel 1*. That is, I am using the distinction between playful and serious (see Play vs. Purpose (p. 54)) in lieu of the one between true and false. The scientific system operates based on the true vs. false distinction (Luhmann 2009), whereas art does not (Luhmann 2000). Thus from a mere performative perspective it would have been possible to "fake" the measurement process. However, this would have made a different difference.

In Alvin Lucier's performance, this difference becomes apparent by watching the artist while he is being prepared with the electrodes as well as during the performance itself. Lucier always keeps a straight face. The reason for this is most likely to avoid any muscular activity that would induce noise into the measurements. Although they do not share the same code (see Discussion (p. 114)), the artistic and the scientific become intertwined, coupled systems.

Being aware of the limitations of the device I am using, the experimental environment and my lack of scientific training,⁵ I embedded *Spiel 1* within an ironic context while respecting its technological background. Thus I implemented genuine data acquisition and analysis algorithms to measure cortical activity based on the difference between alpha and beta waves (Ramirez and Vamvakousis 2012). *Spiel 1* does not feature advanced machine learning algorithms, though. As a performance it does not claim scientific validity, nor is any data used for empirical purposes (see Play vs. Purpose (p. 54)). The override button that is available for the performer of *Spiel 1* to manually trigger the rockets is a nod to the dramatic affordances of the piece.

⁴This metaphor can be read twofold: the brain as source of electric activity observed in the EEG and the computer as transmitter of electrical currents operating in a brain-like manner (Borck 2018, p. 245-253).

⁵I received some training in medical EEG measurements during my PhD project at the Neural Basis for Creativity workshop in April 2016 at the University of Plymouth. The workshop included lectures on neuroscience, creativity and cognitive innovation as well as practical tutorials on EEG methods.

For me, the most interesting process that emerged during the performance was the communication with the participants.⁶ Despite the public situation and the playful threat to the teddy bear to be hit by rockets, players were open about personal feelings, aggression peacefulness and moral questions. *Spiel 1* pretends to be serious although I do not intend it to be so. Yet despite my intentions, the performance offers a space where serious communication can take place.

There is also a third sense, in which *Spiel 1* is playing with the distinction play vs. non-play, which is highlighted by its name, which I chose deliberately to convey a false signification. Like *Brainball*, *Spiel 1* is an anti-game (see above), a notgame respectively (see Games vs. Art (p. 63)). Strictly speaking it is a performance, albeit one with a notgame inside, namely the player who tries to prevent an event from happening — the firing of the rockets. The player cannot achieve the goal by action but rather by doing nothing.⁷

Spiel 1 is one of two projects that I created prior to and re-contextualised for my PhD project; the second one is *Speed Gardening Guerrilla* (see Project: Speed Gardening Guerrilla (p. 138)). As with other projects on the boundary between play and performance (see Project: Hostile Environment Facility Training (p. 40) and Project: Pedestrian Fitness Initiative for Plymouth (p. 135)), *Spiel 1* oscillates between fiction and non-fiction, playfulness and seriousness, sense and nonsense while keeping an ironical distance from its subjects. It is therefore crossing multiple distinctions: playful vs. serious, frivolous vs. purposeful, and in summary play vs. non-play.

2.6 Games vs. Art

The common history of art and video games appears as a history of misunderstandings. When the late film critic Roger Ebert (2010b) categorically stated that “videogames can never be art”, a fierce discussion ensued that spurred Ebert (2010a) to add even more insult to injury. Newspaper columnist Jonathan Jones (2012) took the same line, basically declaring games as entities that lack artistic authorship. In his response, game designer Eric Zimmerman denounced art as a place for games to “stay away from” (Zimmerman 2014a).

⁶In the performance I discuss the visible EEG patterns with the audience and point out notable findings. For example, a participant whose measurement showed almost a flat line revealed that he had long-term meditation and martial art experience.

⁷In the movie *Wargames* (Badham 1983) this option is considered as the optimal move when playing against an all-powerful artificial intelligence.

I am criticising these attitudes as myopic (Straeubig 2020a, (to appear)), on the grounds that they reveal a pre-modern understanding of the art system, essentially missing the last 100 years of art history (Luhmann 2000). I think it is ironic that contemporary art critics like Jones fail to see how their defence of “high art” exactly mirrors the attitude of the French Academy resisting the then avant-garde of the impressionists, a movement that is now considered the pinnacle of visual art (Thompson 2010).

While I disagree with Zimmerman’s dismissive conclusion, I believe that one of his arguments is worth further discussion. Zimmerman does understand that “the art question” (Warburton 2003) does not depend upon the inherent qualities of artworks anymore. This was demonstrated at least since Duchamp’s virtual art experiment (Norton 1917). Both art and games are social systems, and as such, the boundaries that determine inclusion/exclusion of art as well as games are in constant re-negotiation (Luhmann 1996). It is a particularity of art that it invites its own negation into the system (Luhmann 2000). Therefore artworks can signal not to be artworks and nonetheless be recognized as artworks (Kaprow 2003).

Michaël Samyn of the duo Tale of Tales makes the point in his *Notgames Manifesto*: “Can we create a form of digital entertainment that explicitly rejects the structure of games? What is an interactive work of art that does not rely on competition, goals, rewards, winning or losing?” (Samyn 2010). In three landmark exhibitions in 2011, 2013 and 2015 at the Cologne Game Lab, Tale of Tales and other artists such as David O’Reilly, Rebeca Merrill and Vectorpark have exhibited a wide range of (not-)games that critique the form of games (Cologne Game Lab 2011).

Above all, the question “are games art?” which has triggered the debates cited above constitutes a category mistake. This becomes clear when the term “games” in the question is replaced by “movies” or “books”: certain works can undoubtedly be identified as artworks while others would not be considered as such. A useful distinction in this context is the one between medium and form (Luhmann 2000, p. 102-132). Games, books and movies are media in which widely different forms can appear: works of literature, kitsch or operating instructions. Some of those forms are — or will be in the future — recognised as art by the art system, while others fail. The medium itself does not determine the message, in apparent contradiction to the widely shared *bon mot* by Marshall McLuhan (McLuhan and Fiore 2008).

It can be observed that games and art are communicating with each other as a growing number of games is being accepted into the art system (Schrank 2014). Their cultural impact is being acknowledged with significant exhibitions in established art institutions like the V&A in London and the MOMA in New York. Festivals like AMAZE in Berlin, Independent Games Festival (IGF) in San Francisco and EGX Rezzed in London provide social glue and attract artists, developers and players alike. As a result, the discourse around games has become more diverse and relevant regarding cultural issues (Shaw 2010; Ruberg and Shaw 2017; Muriel and Crawford 2018). This development is furthered by debates about the aesthetic dimension of games (Catlow, Garrett, and Morgana 2010; Sharp 2015).

Both games and play take place in art contexts, with or without a formal invitation (see Playgrounds vs. Non-playgrounds (p. 125)). Since ancient times, play has occupied theatres, opera houses, circuses and sports arenas (Huizinga 1955). As illustrated in section Andersen and Stott: Play at Play (p. 37), playful performances have become common occurrences in contemporary art (Stott 2015). Art and play also share an autotelic quality — the absence of external purposes — expressed by the doctrine of *l'art pour l'art* (Wilcox 1953) (compare Play vs. Purpose (p. 54)).

2.7 Play vs. Games

While discussing Games vs. Art (p. 63) in the previous section, I briefly skipped over the distinction between play and games. In this section, I will catch up and illuminate aspects of this fundamental distinction. To discuss games, I adopt points of view from cultural studies, which observe games as media and as artefacts (see also Play and Discipline(s) (p. 151)).

Let us consider initially play as the activity that takes place when a game is in progress. As a designed artefact, a game gives play structure by providing a set of formal and dramatic elements: conflict, mechanics, outcomes, objectives, rules, resources, story, environment, characters, a premise, challenge, avatars (Fullerton 2008)⁸ In this practice-oriented approach, play is one aspect the game designer has to consider, albeit a central one (compare Towards Play Design as Research (p. 154)).

⁸In this description, I have left out the element of the player which becomes a topic in Human vs. Machine (p. 97).

However, as Salen and Zimmerman point out (Salen and Zimmerman 2003, p. 301-311), there are two readings of the relationship between game and play. The first one is to view play as an element of games, which is compatible with Fullerton's description above. This view is based on the system/element distinction (compare Luhmann: Distinctions Create Meaning (p. 33)).

From the second perspective, however, games are a subset of play. This appears plausible, too, because play happens not only within games but outside of them as well: on playgrounds, in the free play of children, in all kinds of playful behaviour. From this perspective games can be considered a special case of play, where the elements listed by Fullerton are present. So we arrive at a paradoxical situation, with play an element of games and game a subset of play: we are looking at a strange loop.

As I have described in What Is Play? (p. 15), paradoxical findings are noted but rarely resolved in classical ontological frameworks. They do however provide a potential for *Anschlussfähigkeit* in a dialectical manner. Thus Suits' attempts at definitions of both games (Suits 1978) and play (Suits 1977) are discussed by (Morgan 2008) and by Myers (Myers 2012) who both criticise Suits, on different grounds yet with the same result: more variants are added to the pool of existing definitions.

Not less problematic are the attempts to identify common attributes of games and play. When Frasca notes that both games and play have rules, he is in fact describing a distinction between external, given rules that characterise games and play rules that may be liminal, intrinsic, emerging in a fictional world or through repeated action like tossing a ball back and forth (Frasca 1999).

Ingold, discussing aspects of time on the background of Sassure's analogy between language and a game of chess, also takes note of this difference: "Once you win the game it is finished; [...] Social life, to the contrary, must continue" (Ingold 2016, p. 175). This is reminiscent of Luhmann's concept of *Anschlussfähigkeit*, except that it is compatible with the possibility that social systems in the game's environment, understood as autopoietically created sequences of events do cease to continue. A game ends and the players, perhaps out of disappointment by the losing party, do not talk to each other anymore.

It appears useful to me to cross the distinction between play and games with the one between medium and form (Luhmann 2000, p. 102-132). We can view a game as a medium in which forms of play can be observed. This does not preclude play to appear

outside of games, nor does it negate other forms to appear within games (compare Play vs. Learning (p. 56)). What it says is that games provide elements that are loosely coupled such that forms of play can emerge. A further analysis would be concerned with the structural qualities of those elements, for example, with the uncertainty that is provided through game mechanics (Costikyan 2015). Instead of shoehorning play and narration into a ranking order, it makes sense to identify elements that enable or resist storytelling (see Ludus vs. Narratio (p. 85)).

It is also possible to reverse the direction of the medium vs. form relationship and view play as the medium, with games appearing as forms within that medium. In contrast to the logical conflicts induced by the part-whole relations discussed above, no contradictions manifest themselves. Yet other paradoxa do become manifest in the observation of play. Before I attempt to summarize these aspects, I want to draw attention to phenomena that point against the positive and affirmative stance towards play — its dark side.

2.8 Play vs. Dark Play

In the previous sections, my discussions of play invite a largely affirmative reading, declaring play as a necessary counterweight to work (see Play vs. Work (p. 51)), identifying positive effects on learning and creativity (see Play vs. Learning (p. 56)) and postulating play and art as the last autotelic islands in a sea of externally imposed purpose (see Play vs. Purpose (p. 54)). But play can also have quite opposite connotations.

In this section I want to look at the other side of the coin and discuss phenomena of play that range from unpleasant and controversial to outright harmful. Given the ubiquity of play we can expect a certain range of “dark” phenomena. Mortensen, Linderöth, and Brown (2015) have collected a range of investigations into controversial themes associated with various forms of play, especially in the context of games (see Play vs. Games (p. 65)).

Johan Huizinga (1955, p. 89-104), who has been criticised for a perceived glorification of antagonistic manifestations of play (see What Is Play? (p. 15)), claims that play includes tournaments, ritualised conflict and even war, justified by a heroic motive of loyalty. Richard Schechner (1998, p. 16) on the other hand stresses the significance of play as ritualistic and creative destabilization, “wherein the play frame is absent, broken, porous, or twisted.” Having observed the unbridled joy of players that have voluntarily submitted to the artworks

Painstation (Reiff and Morawe 2001) and *Inferno* (Demers and Vorn 2015), I can testify to the compatibility of play and physical discomfort.

Those kinds of are absent from modern debates about violence in video games, which rather echo previous discussions about the negative impact of media such as film, comics and novels. Debates about media violence cross distinctions discussed in the next chapter (Virtual vs. Real (p. 73)), while the scientific judgement is oscillating between two opposites: catharsis and imitation. Catharsis means that the exposure to violence has a “cleansing” effect; a theory that has been ascribed to Aristotle (compare *Paradoxa of Play* (p. 69)). Opponents of this idea have pointed to the harmful nature of virtual violence and claimed causal links to sustained aggressive behaviour (Anderson and Dill 2000).

However, I claim that games are media like books or film and therefore they must be able to express controversial and disturbing themes such as domestic violence against women (Sinkler, Phillips, and Rijke 2017). This also has consequences for crossing distinctions between the diegetic and the non-diegetic (see *Magic vs. Pervasive* (p. 128)). While scientific debates about cause and effect regarding the consumption of video games and violence are ongoing, connections between a cultural identification as “gamers” and antisocial behaviour can be observed. Recurring incidents of online harassment and cyberstalking in the so-called “Gamergate” phenomenon (Mortensen 2016) show up as a particular instance of Sutton-Smith’s rhetoric of play as cultural identity (see *What Is Play?* (p. 15)). For Sutton-Smith, in accordance with Bernie DeKoven, community-building aspects of play can be non-competitive and beneficial (DeKoven 2013). This optimistic and welcoming stance represents one side of play as identity, festivals and as opportunities for dropping social boundaries. Gamergate, as an epiphenomenon of playing video games, exemplifies the hostile side of identification, an attempt to define and entrench a certain identity of “gamer culture”, justifying violence and harassment. It has prompted academic reactions (Ruffino 2016) as well as direct opposition⁹ (Alexander 2014).

Far from the level of cultural antagonism manifest in social systems, biological systems engage in playful agonistic activities, namely in “rough and tumble play”, a widespread behaviour observable in animals and children. It involves physical conflict while lacking an intention to harm the opponent. Yet scientists describe its function as a preparation for actual hostile confrontations (Burghardt 2005b). It therefore relates to the boundaries

⁹This evokes Huntington’s hypothesis that clashes between cultural identities are becoming the prevalent lines of conflict (Huntington 1993). In the case of Gamergate, cultural identity emerges in virtual communities, an effect that has been observed empirically, see for example (Rafał 2013) and (Baltezarevic et al. 2019).

between virtual and real (compare Virtual vs. Real (p. 73)). In terms of cultural impact, video games and AI have evolved separately and at a different pace. In the past, debates about games were dominated by tropes of hazard (Anderson and Dill 2000) and addiction (Griffiths, Kuss, and King 2012), until scrutiny, critique and meta-analyses began to add some much-needed counterweights to the discussion (Griffiths and Davies 2005; Ferguson 2015; Bean et al. 2017).

Another “dark” phenomenon of play is questioning the definition of play as voluntary (see What Is Play? (p. 15)). In contrast to external obligations, play is considered autotelic and voluntary (compare Play vs. Work (p. 51) and Play vs. Purpose (p. 54)). In the context of playbour in Massive Multi-User Online Role-Playing Games such as *World of Warcraft*, instances of forced play have been reported (Nakamura 2009). Play, the epitome of voluntary activity becomes forced labour, an obvious paradox.

2.9 Paradoxa of Play

Arguing from the multitude of perspectives I have been considering in this chapter, I want to come back to the question of why I claim that distinctions, not definitions can provide a comprehensive description of play. By travelling across distinctions, we have already encountered many phenomena that are paradoxical, contradictory or conflict with each other.

A central paradox of play is the distinction between first person and third person perspective. In other words, the fundamental difference between what I am experiencing during play and what someone observes who is watching me play.¹⁰ The latter includes a second-order observer, the play researcher who constructs the experimental setting and produces scientific artefacts such as hypotheses, theories, experiments, measurements and academic papers (compare Play and Discipline(s) (p. 151)). The former comprises immediate impressions, emotions and thoughts: the phenomenology of my individual experience.

This epistemological gap is not particular to play, and philosophy has had a long tradition in discussing the relationship between a first and a third person perspective (McGinn 1996). Fundamentally, I do not have direct access to someone else’s mind, neither has

¹⁰A second possible path to follow at this point is the distinction between what you are experiencing vs. what I am experiencing, which leads to questions further discussed in chapter Human vs. Machine (p. 97).

the scientist. It remains a black box (see Von Foerster: Second Order Cybernetics (p. 29)). Therefore, we must rely on taking part in communication and observing it (compare Luhmann: Distinctions Create Meaning (p. 33)).

In section Play vs. Purpose (p. 54) I have speculated that the purpose of play is likely to be influenced by the purpose of the observer — restating the idea of Sutton-Smith's rhetorics (see What Is Play? (p. 15)). Now I can state my conclusion more clearly: A child that is put inside a laboratory is likely not playing in the same way it is playing outside of the lab. Even if we assume that the child entering the experimental situation might forget after some time that there is a camera in the corner of the room, that it was greeted by someone in a white lab coat, that their parents were signing some documents, it is still within a scientific environment, experiencing conditions that are shaped by work. The empirical scientist prepares the situation based on a particular research question and the anthropologist makes their observation based on a previous body of knowledge (see Play and Discipline(s) (p. 151)).

Jeffrey Goldstein criticises research about video games and violence (see Play vs. Dark Play (p. 67)) on similar grounds: "In laboratory experiments, no one plays. Being required to play a violent game on demand is not play. Play is voluntary and self-directed, something that cannot be captured in a laboratory experiment" (Goldstein 2001).

In our hypothetical situation, the child might play along and imitate play to please the adults but it would not encounter the same environmental conditions if it would play by itself without the experimental context (see System vs. Environment (p. 123)). For me this represents the paradox of play: play can be only experienced when there is no non-ludic observer or when the player is not aware of the observation. Thus the scientist is forced to cheat¹¹ When scientific observation is present, the phenomenon is likely not to be play. This strange loop of an observation that is affecting the observed reminds of phenomena in quantum physics (compare Maturana and Varela: Perception Is Distinction (p. 32), footnote).

While this issue is not limited to play, I think it is important to highlight it in the context of a discipline that is still seeking its methodologies (see Play and Discipline(s) (p. 151)). I would therefore identify the observer problem as the most significant paradox associated with play. There are, however, other examples that have been discussed by scholars of

¹¹The scientist also has to construct a perceived impact of the experiment in order to justify the necessity of cheating and to obtain ethical clearance for it (see Discussion (p. 141)).

play and games.

One is the relationship between play and games itself that I have described in section Play vs. Games (p. 65). Other perceived paradoxa concern games proper. Jesper Juul (2013) has identified a puzzling attitude towards failing in video games that he calls the paradox of failure. He claims that in contrast to situations outside of games, players actively seek failure in games and that they seem to enjoy it. Juul admits that similar observations can be made about stories and drama, but he argues that games are special, because the player is confronted with her own failure, failure is used for improvement and the consequences of a video game are not tangible¹² (see Actual vs. Potential (p. 83)). The observation that people are actively seeking exposure to tragic, controversial and violent content has traditionally been explained with catharsis, a concept that originates from Aristotle (Gilbert 1926) (compare Play vs. Dark Play (p. 67)).

Kolnai (1965) describes a slightly different perspective, claiming that games understood as events that take place in space and time expose a paradox, because there is a conflict between the player's goal of sustaining the game and making an end to it by winning the game. Carse (1987) takes the distinction between finite and infinite games further into the philosophical and even spiritual realm. Carse distinguishes playing ordinary, finite games from the aspiration of a playful life (compare the speculation "Everything is play" in section Counterpoint: Machines Play (p. 118)). We can find a similar spirit in DeKoven's description of the "playful path" (DeKoven 2014).

Myers (2012) debated Suits (1969) who in turn critiqued Kolnai (1965) over a second paradox of play. Their topic concerns what Kolnai calls "the vacuity of agonistic pursuit within the game" where players fight over things that have no "real" value.¹³ This leads directly to the main distinction of the next chapter: virtual vs. real.

2.10 Summary: Distinctively Playful

In this chapter I have explored the inter-relationship between play and non-play through a variety of distinctions. Starting from the distinction between play and work, I have made

¹²There are many situations where playing games carries tangible consequences (compare Play vs. Dark Play (p. 67)) and for this argument to be valid, Juul needs to construct an idealised situation in which the game is purely played for its own sake (see Play vs. Purpose (p. 54)).

¹³There is a certain irony in the fact that Kolnai chooses chess, a game that is widely played in the context of professional sports with prizes attached as the example for a game without "real" outcomes.

use of my systems-theoretic approach introduced in chapter Distinction vs. Identity (p. 15) in order to observe a wide range of phenomena related to play.

Furthermore, my chosen methodology makes it possible to observe other observers, while avoiding reductionism, a stance where play is explained from pre-existing principles inherent in the observer. *Spiel 1* has served as a playful example for my critical reflection of the problematic notion of serious games made for pedagogic purposes.

As a recurrent theme, I have been crossing various boundaries between an inner and an outer space: first person vs. third person perspective, intrinsic vs. extrinsic purpose, the cybernetic black box vs. the glass box. Attempts to keep play firmly on one of those sides, however, must be considered futile: play escapes categorisation and continuously crosses these distinctions, playfully.

For example, consider the discussion about internal vs. external purpose (see Play vs. Purpose (p. 54)). One might conclude that play connects us to ourselves in an autotelic manner, while work brings external purposes to light. But we can immediately see how play, like work, connects us to other participants within a social system. We still can acknowledge the whimsical nature of play, yet play in itself becomes more meaningful. All we have to do is to cross the distinction between psychic and social system.

A significant aspect of play that has not been discussed so far appears in what psychologists observe as pretend play. Huizinga (1955) and later Salen and Zimmerman (2003) describe play happening inside a “magic circle”, where different laws govern our behaviour than outside of the play experience. We are also reminded that play comes along with fictional stories, with unicorns, monsters and strange universes. Therefore, it is time to clarify the various relationships between play and reality.

Let us enter the magic circle.

Chapter 3

Virtual vs. Real

Virtual Reality is a rather miserable idea.

Slavoj Žižek (2012, p. 3)

3.1 Is Play Real?

In the previous chapter, I have navigated through a manifold of phenomena related to play by following a particular path through a set of distinctions. A significant aspect of play, to be discussed in this chapter, concerns its various relations to reality.

I have touched upon ontological questions in section Definitions vs. Distinctions: What Is “Is”? (p. 23) in the context of explaining my methodology. I started from a critique of methods rooted in identity and definitions and then continued by observing phenomena through the lens of distinctions, without concern about what “reality is”.¹ Being/not being can then be observed as a distinction, in lieu of an assumption of some externally given metaphysical entity. Similarly, Luhmann (1996, p. 12) is not too much concerned about ontological premises: “The following considerations assume that there are systems”. As discussed in section Spencer Brown: Draw a Distinction (p. 28), the “trick” is to set an act of observing into motion by drawing a distinction. This allows other observations to follow, an actualisation of possibilities that in turn produces meaning, the medium in which truth, reality and knowledge are constructed. The mind as an autopoietic system (see Maturana and Varela: Perception Is Distinction (p. 32) and Luhmann: Distinctions Create Meaning

¹Thus I was able to avoid an infinite regress that is triggered by the self-referential structure revealed in that expression. “What reality is” presupposes its own target of investigation. For a discussion of that circularity see for example (Heidegger 2013, p. 194-195).

(p. 33)) ascribe meaning and social systems communicate within it. The evolved social system that operates with knowledge and is concerned with the distinction between true and false is the system of *Wissenschaft*, the sciences and the humanities.²

My own starting point was the distinction between virtual and real that is latent in the concept of virtual reality. In 2016 I began to design and deliver workshops that interrogate this distinction in practical and theoretical ways. In the following sections I will discuss this project before returning to the question in what sense we can characterise play as real. I will clarify different concepts of reality and non-reality and describe how truth, reality and meaning play together. By crossing over to the other sides of these distinctions, concepts such as imaginary, pretend play and narration will appear. Finally, I will come back to the distinction between virtual and real.

In the following sections I will again take the position of a second-order observer (see Von Foerster: Second Order Cybernetics (p. 29)) by looking at the distinctions that other observers operate with, in order to identify real and non-real aspects of play. What do concepts like actual, potential, virtual and real reveal about play and games? How do the sciences and humanities differ in their respective approaches? Which distinctions do they select to observe play? What is the role of the medium and how do we make sense of fictional accounts, of make-believe and of pretend-play? Can we draw meaningful distinctions that have been overlooked, shift our focus or revisit others? To pursue these answers, let us enter a virtual reality.

3.2 Project: Imperfect VR

“ARE WE LIVING IN A VIRTUAL REALITY? It doesn’t matter. It is on us, the creators and inhabitants of virtual worlds, to decide and shape the realities we are going to experience. Are we going to consume the visions of large corporations that are keen on selling us their latest branded outputs for entertainment? Or the creative, quirky, touching, open, experiences that connect us to a deeper meaning of what it is to be human (or a bat³)” (Straeubig 2016e).

The above quotation is taken from the material for my *Imperfect VR* project. It consists of a

²In the German language, “Wissenschaft” encompasses the sciences (Naturwissenschaften), social sciences (Sozialwissenschaften) and the humanities (Geisteswissenschaften). I am using “academia” and “sciences and humanities” as umbrella terms for these disciplines.

³The bat is an allusion to Thomas Nagel’s essay (Nagel 1974) (see Exploring the Virtual (p. 91)).

manifesto (see Discussion (p. 77)), a series of workshops and an open source codebase.

3.2.1 Development

I began developing *Imperfect VR* in summer 2016, when I delivered the first workshop at Electromagnetic Field, a bi-annual, non-profit community event that takes place outdoors.⁴ I created a presentation, handouts and code examples featuring a number of small, interactive virtual reality scenes. The code for the workshops is written in HTML and JavaScript. It is hosted on a web server, which can be run locally or from an address in the internet. Part of the workshop consists in setting up a coding environment, so that participants can continue to work on their virtual worlds later.

Since the beginning of the project, I keep updating the materials for *Imperfect VR*. The code is based on A-Frame, an open source Web VR framework developed by volunteers under the stewardship of the Mozilla Foundation.⁵ This framework is being updated from time to time with new features and fixed bugs. The software also must be adapted to technical developments and changing restrictions for Web browsers running on mobile devices. In addition, I am examining and revising workshop materials before and after each event, integrating discussion points, adding new references, and adapting instructions.

3.2.2 Exposition

Since 2016, I have given a dozen workshops, commissioned by various organisations, with approximately 250 participants in total. The events in detail:

- Electromagnetic Field, Guildford, UK (August 2016)
- Off the Lip, Plymouth University, UK (October 2016)
- Royal College of Art, London, UK (November 2016)
- Space Art and Technology, London, UK (February 2017)
- Future Imperfect Symposium, Plymouth University, UK (April 2017)
- Doomed Gallery, London as part of Antiuniversity Now, London, UK (June 2017)
- Vivid Projects, Birmingham, UK (August 2017)

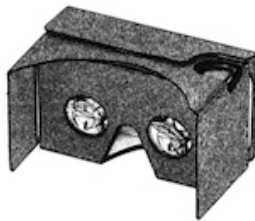
⁴<https://www.emfcamp.org>

⁵<https://aframe.io>

The 3-part Imperfect VR Manifesto*



This is a Smartphone



This is a Cardboard



This is A-FRAME
aframe.io

Now Make a VR !

* based on The 3-part Imperfect Cinema Manifesto: imperfectcinema.com

@crcdng

Figure 3.1: The Imperfect VR manifesto

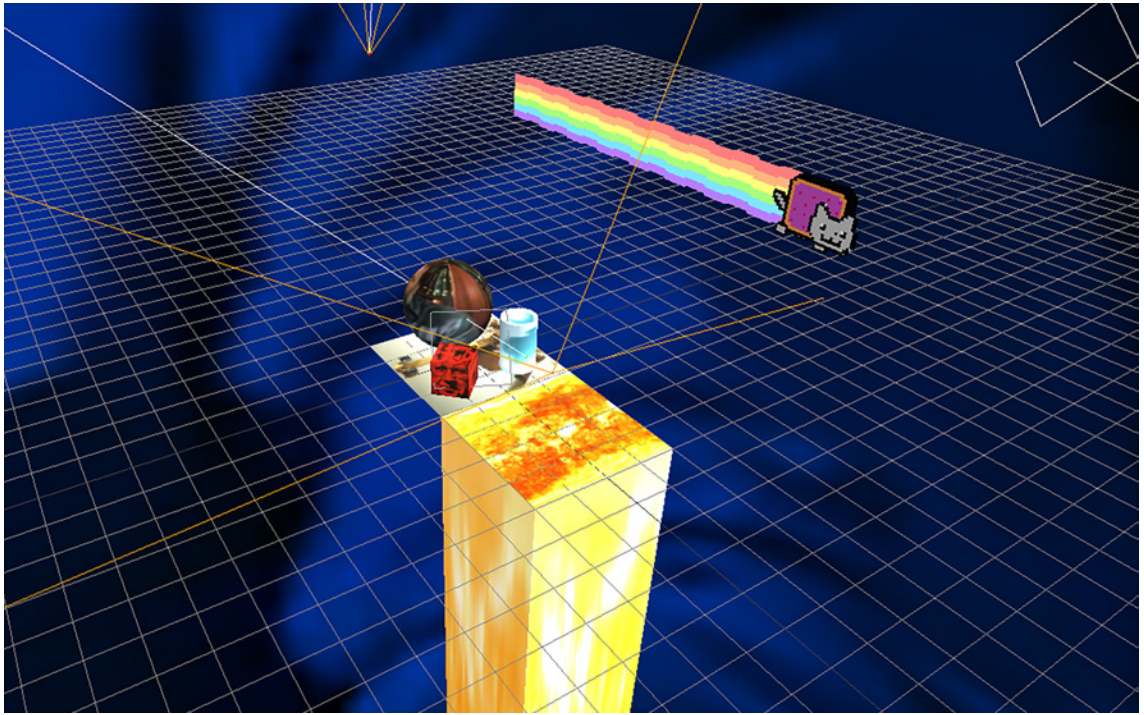


Figure 3.2: A scene created for Imperfect VR

- Games and Simulation enhanced Learning (GSeL) conference, Plymouth, UK (November 2017)
- Shanghai Maritime University, Shanghai, China (November 2017)
- Donghua University, Shanghai, China (November 2017)
- Social Fiction Lab, Berlin, Germany (February 2018)
- 35th Chaos Communication Congress (35C3), Leipzig, Germany, as part of the Social Fiction Society (December 2018)

The *Imperfect VR* codebase is published under the open source MIT License (Straeubig 2016e). The code and learning materials can be freely used, modified and deployed under the condition that the included copyright notice is retained.⁶

3.2.3 Discussion

I created *Imperfect VR* in a reaction to issues that I noticed in the evolution of virtual reality: a reductionist focus on technical aspects, commercial pressure and exclusionary conditions. The spirit of *Imperfect VR* is summarised in the slogan “We are not aiming for

⁶The code and materials are available at <https://github.com/i3games/imperfect-vr>.

a perfect reality but will have fun in the virtual.” and in the *Imperfect VR* manifesto depicted above.

The project aims at the distinction between consumers and creators. In his famous statement “the medium is the message”, Marshall McLuhan reminds us that the introduction of a new medium is simultaneously restructuring personal and social relations⁷ (McLuhan 1994). This process raises questions about ownership and control. How will the production, distribution and consumption of VR content be organised? Who will build and control future virtual worlds? A multi-billion industry? Some highly trained specialists? Or can it be everyone? Will the majority of people consume this medium from corporate app stores or will a wider demographic be able to create experiences for themselves and for others?

Game designer Robert Yang gets to the heart of this issue, when he says: “Artists and queers and weirdos need to hit VR now, and hit hard, before VR culture ends up as conservative as the worst of gamer culture” (Yang 2016). Yang pleads with urgency for a diversity of voices among the creators of virtual reality, against the background of a “gamer culture” that is grounded on excessive self-identification by a group of video game consumers (Mortensen 2016) (compare Play vs. Dark Play (p. 67)).

This is a powerful call to arms, but where do these diverse creators come from, how do they share knowledge, what are the social structures⁸ and what are the tools that empower them to contribute? There is a historical analogy to film-making, mirrored in the origin of *Imperfect VR* and its manifesto which is inspired by the Imperfect Cinema project initiated by Allister Gall and Dan Paolantonio.⁹ Imperfect Cinema interrogates the idea of imperfection, using film as research into participatory practices (Gall 2016). That project, which created and nourished a longstanding community of do-it-yourself film-makers, in turn is inspired by the essay “For an imperfect cinema” by Julio García Espinosa (1979). Espinosa identifies revolutionary potential in the antithesis to technical perfection, which is pursued and promoted by the mainstream film industry located in Hollywood.

This “emancipatory potential of imperfection” (Gall 2016, p. vi) can be applied to virtual reality as well. I believe that it is possible despite a growing commercialisation for a wider range of people to create their own virtual experiences. To explore this claim in practice,

⁷This is why the distinction between VR as a technology and VR as a medium matters. While the technology is 50 years old (Sutherland 1968), I contend that the medium is just emerging.

⁸My own experience as a lecturer has led me to believe that the traditional education system is less likely to support this kind of diversity, as both student and industry expectations as well as high barriers to entry work against it.

⁹<https://imperfectcinema.com>

I developed *Imperfect VR* as a set of workshops that enable participants to create their own, imperfect virtual reality experience with a few lines of code. Participants usually bring their own laptops and smartphones, while cardboard VR viewers are provided by the hosting organisation.¹⁰ The software used in the workshop as well as the specification for the cardboard viewers is open source (Google VR 2016). A code repository on GitHub contains all code and artwork files as well as further resources. I do not assume that participants have any pre-existing experience with computer programming and the workshop announcements are carefully worded to avoid technical jargon.

At the end of each workshop, the participants have created a small VR world by themselves and have received feedback on how to continue. In addition to teaching basic skills for VR development, we discuss cultural, economical, political and philosophical implications of VR, drawing from resources such as Harman's "Brain in the Vat" thought experiment (Harman 1973), Berger's and Elkins' constructivist approaches to perception (Berger 2008; Elkins 1997) and Žižek's critique of the distinction between virtual and real (Wright 2012) (see *Exploring the Virtual* (p. 91)).

Imperfect VR is my contribution to the development of Virtual Realities (compare *Experiential Architecture* (p. 160)), an attempt to foster a diverse ecology of creators and production practices accompanied by critical reflection. If virtual and augmented reality will play larger roles in the future, these are factors that I would like to see more often.¹¹ Utilising the medium vs. form distinction (see *Play vs. Games* (p. 65)) has been useful in this respect: framing VR as a medium through which a variety of forms can appear invites curiosity, creativity and experimentation. The attitude of imperfection that I adopted from *Imperfect Cinema* was the key to fearlessly approach questions such as: What can be expressed within this medium? Which forms are possible? What happens when one tries to break the limitations? To discuss these issues in more depth by observing different distinctions, a closer look at notions of reality is required.

3.3 Virtual vs. Physical

My critique of the reality of virtual reality expressed through *Imperfect VR* is grounded in what I see as an over-emphasis of technological discourses to the detriment of cultural and

¹⁰Usually, a nominal fee is charged in order to contribute to the costs and to prevent no-shows.

¹¹The distinction between virtual and augmented reality, discussed in section *Virtual vs. Physical* (p. 79) does not make a difference in this context, therefore I can omit it here

political concerns. Whereas accounts like Rheingold (1992) and Woolley (1993) hint at the cultural utopianism with which virtual reality was perceived in the early 1990s, the present “reality of the virtual” (compare *Exploring the Virtual* (p. 91)) feels mainly technology driven.

Its central concepts like mixed, augmented and virtual reality are based on purely technological distinctions, in particular on Milgram et al.’s taxonomy that aims to describe a spectrum between “real” and “virtual” displays (Milgram, Takemura, et al. 1995; Milgram and Kishino 1994). Augmented reality denotes the case where computer generated objects are added to the perception of the physical surrounding, whilst in virtual reality, the complete visual perception is computer generated. Mixed reality describes all situations that are neither purely virtual nor purely physical, which includes augmented reality as a special case.

While the paper by Milgram et al. describes visual displays, the authors claim that “many of the concepts proposed here pertain as well to analogous issues associated with other display modalities” (Milgram and Kishino 1994, p. 6). Without further explanation they then discuss “virtual objects” and “virtual worlds”¹² (Milgram and Kishino 1994).

My goal in the present discussion is to illuminate the underlying distinction between virtual and real, which Milgram and Kishino (1994, p. 6-7) express in the following pair of definitions: “Real objects are any objects that have an actual objective existence” and “Virtual objects are objects that exist in essence or effect, but not formally or actually”. Although the first definition appears tautological, it rests on the silent assumption of naïve realism (see *Reality vs. Truth* (p. 88)). Thus I prefer to distinguish virtual reality (in the technical sense) from physical reality, the perception of computer-generated images from the perception of the physical environment.

The second definition alludes to the Aristotelean concept of potentiality. In the conjunction of both, we can observe a pair of distinctions, real vs. imaginary (see *Real vs. Imaginary* (p. 80)) and actual vs. potential (see *Actual vs. Potential* (p. 83)).

3.4 Real vs. Imaginary

Controversial debates like the one between Burghardt and Sutton-Smith (see *What Is Play?* (p. 15)) can possibly reveal a multitude of distinctions. While opposing positions

¹²This indiscriminate conflation of concepts such as display, perception and world is a concern that I would like to address in a future inquiry.

illustrate the most salient contradictions, it is equally worth paying attention to what is not said, through silent assumptions, deliberate omission or other factors. With this in mind, I am analysing the recent discourse between the philosopher David Chalmers and the game studies scholar Jesper Juul.

Chalmers (2017) draws a distinction between virtual and real by arguing that “virtual reality is a sort of genuine reality, virtual objects are real objects, and what goes on in virtual reality is truly real” (Chalmers 2017, p. 1). In particular, he describes two realities where virtual objects exist in virtual space, having virtual properties, affecting each other as well as our perception. They also exist as digital objects in the same way that data structures and algorithms exist within the computer. Both modalities are real, Chalmers argues, by attributing causal powers to virtual objects, but he neglects to delve deeper into the phenomenology of virtual experiences. Instead, he postulates that a “naïve” perceiver would not be able to draw a distinction between virtual reality and ordinary experience while a “sophisticated” one would be able to observe a distinction.

Juul argues with this position by stating that virtual objects are designed for particular, limited sets of interactions that arise from the intentions of the designers to provide fictional contexts (Juul 2019). Therefore, according to Juul, everything in VR is purely fictional.

I want to point out that in this debate both Chalmers and Juul adopt virtual reality more or less in its technological sense (see *Virtual vs. Physical* (p. 79)) and that both settle on naïve realism (compare *Reality vs. Truth* (p. 88)). I find more informative concepts in the contributions of Wolfgang Iser (2000), Brian Massumi (2002), Espen Aarseth (2016) and in Gehmann and Reiche (2014). These authors reflect on notions of virtuality and of reality, such as Aarseth’s ludo-hermeneutics, which draw attention to new distinctions. I will observe some of them in the next sections, after looking at the fundamental question about the genesis of play.

Winnicott (2010) identifies the origin of play in the space between mother and baby, when the infant transitions between stages of development between inner and external reality. We might say that in the phenomenology of the child, biological, psychic and social systems begin to differentiate and it constructs its realities in and through play. Sutton-Smith denotes these developments as “rhetorics of child play” (Sutton-Smith 1997, p. 35-51) and “child phantasmagoria” (Sutton-Smith 1997, p. 151-172).

During their development, children engage in deliberate counterfactual play (Piaget 1962),

a phenomenon psychologists call “pretend play” (Jarrold et al. 1994). To pretend, one must be able to distinguish two realities, the one that is pretended and the un-pretended one. Does a child play before it can make this distinction? For adults, this distinction is central to role-playing activities and games in which players construct imaginary realities by temporally assuming different names, roles and identities (Sutton-Smith 1997, p. 91-110) against the backdrop of their real ones. Alternate reality games (ARG) like *I Love Bees* (42 Entertainment 2004) play a strange loop with reality by pretending not to be a game, a design principle known as TINAG (“This is not a game”). An extreme form of an ARG is depicted in the movie *The Game* (Fincher 1997) where the protagonist is drawn into an elaborate play with fiction and reality. By denying their game character, alternate reality games both create and challenge the magic circle and play with their players’ suspension of disbelief (Szulborski 2005).

The observation that play takes place within different realities is expressed prominently in Huizinga’s concept of the magic circle (Huizinga 1955). Game designer Eric Zimmerman has managed to both popularise it (Salen and Zimmerman 2003, p. 92-99) and to downplay its significance (Zimmerman 2012). In analogy to the debate concerning ludology vs. narratology (see Ludus vs. Narratio (p. 85) and Play and Discipline(s)), the magic circle has occupied the game studies, with both attackers (Consalvo 2009) and defenders (Stenros 2012) on the fence.

I agree with Zimmerman that assuming an environmental boundary for play presents a useful design concept, in particular, I would add, in the context of autopoietic systems (compare Maturana and Varela: Perception Is Distinction and System vs. Environment (p. 123)). However, it is crucial to understand that in particular social systems do not necessarily represent physical, spatial or temporal boundaries, but operational closures. This is beautifully illustrated by *Rogue Game, First Play*, a playful artwork by Sophie Warren and Jonathan Mosley. Its proposition states: “Seek out an indoor sports hall with markings of at least three different game courts or pitches overlaid. Enlist teams of players for each game. On court assemble the players dressed to indicate team and game. On the whistle, simultaneously all games begin. Each game is played for its official duration” (Warren and Mosley 2012). The three simultaneously running games share space, time and symbolic environment while operating autonomously and irritating each other (compare Luhmann: Distinctions Create Meaning (p. 33)).

Finally, if all cultural life is born in the space between infant and mother that Winnicott calls the “third area” (Winnicott 2010, p. 95-103), then this area of play represents the primordial magic circle. It is the area in which the first distinction is drawn by an awaking mind: “[. . .] our first attempt to distinguish different things in a world where, in the first place, the boundaries can be drawn anywhere we please. At this stage, the universe cannot be distinguished from how we act upon it, and the world may seem like shifting sand beneath our feet” (Spencer-Brown 2008, p. v).

3.5 Actual vs. Potential

The second distinction that spawns from the discussion in section Virtual vs. Physical (p. 79) is actual vs. potential. Historically derived meanings for “virtual” like strength and virtue (Shields 2003, p. 1-17) can be understood as describing a potential to exert certain effects in the world. Deleuze has called such effects “capacities” and denotes capacities that are not actualised as “virtual” (Deleuze 1994).

Virtual denotes one side of a distinction, where the other side is actual. It is a distinction within a second distinction, the one between what is possible and what is not. In contrast to the distinction real vs. imaginary, both the actual and the virtual capacities denote modalities of reality. In systems-theoretic terms both actual and virtual are possibilities and it is the act of actualising these possibilities that constitutes meaning (see The Meaning of “Meaning” (p. 87)), both for minds and for communication (Baecker 2013a).

I am therefore inclined to propose that we replace the technical notion of virtual reality discussed in section Virtual vs. Physical (p. 79) with the idea of virtual realities, the multitude of constructed realities that are waiting to be actualised. The former is concerned with fidelity of reproduction, the grade to which a simulation models reality and the extent to which it feels present (compare Presence vs. Immersion (p. 127)). Virtual realities, in contrast, are simply the possibilities from which we select the actual reality.

The division also allows these virtualities to be expressed within fictional contexts without running into strange self-referential loops. I will turn towards a few examples in the following

section.

3.6 Virtual vs. Fictional

In many cultural and technological contexts, fiction and reality are interwoven, influencing and fertilising each other. Virtual reality has inspired authors, artists and designers and in turn the production and reception of new technology is influenced by narrative accounts.

The holodeck is a fictional device from the television and movie series *Star Trek* that allows crew members to interact with holograms. It was inspired by a laboratory in New York City, built by one of the world's first holographers (*Meet The Man Behind The Holodeck, Part 1* 2014). The holodeck represents a techno-utopist version of mixed reality — as long as the fictional technology remains functional. Despite an integrated safety subsystem, it regularly malfunctions, creating dramatic situations for the protagonists. These incidents, as described in (Memory Alpha Fandom Editors 2018), illustrate a host of speculative and ethical questions.

One of the recurring topics regarding new forms of media is the danger of addiction (Griffiths, Kuss, and King 2012; Bean et al. 2017; Griffiths and Davies 2005). *Strange Days*, a 1995 science fiction thriller directed by Catherine Bigelow (1995), depicts a dystopian view of virtual reality. In the movie, virtual reality consists of 360 degree recordings of people's experiences, replicating their memories and sensations in an absolutely realistic fidelity. The hyper-immersive quality effectively acts as a highly addictive drug and consequently the technology was made illegal.

The VR-as-drug trope is also present in *Snow Crash*, a cyberpunk novel written by Neil Stephenson (2011). *Snow Crash* is a cyber-drug which replicates as a computer virus inside virtual reality. However, it also can bleed (see Magic vs. Pervasive (p. 128)) into the (fictional) reality of the novel and infect the person represented by the avatar. The book depicts a metaverse of connected, collective virtual shared spaces. The author of *Snow Crash* serves as “Chief Futurist” of Magic Leap, a technology company that offers a mixed reality headset. Magic Leap has published its updated vision of the metaverse, the “Magicverse” (Abovitz 2019), which in turn is inspired by Walt Disney's mid-1960s Experimental Prototype Community of Tomorrow (EPCOT) (Gennawey 2014).

Ready Player One, a novel by Steven Cline (2016) that was made into a movie by

Steven Spielberg (2018), picks up retro-gaming and virtual reality as plot devices on the background of a dystopian future. The nostalgia of playing retro video games can be analysed through the tension between the fictional space of the game and the social space of media reception (Felzmann 2010).

Multiple distinctions between fictional, real and virtual appear in the comparison of William Gibson's novel *Idoru* (Gibson 2011) with Hatsune Miku, a virtual idol developed by Japanese media company Crypton Future Media (Zaborowski 2016). In the story, Rei Toei is a famous virtual pop idol that is rumoured to be married to a human rock singer in Seattle. In reality, the virtual idol Hatsune Miku, developed from a piece of speech synthesis software, has evolved into a celebrity with an own Manga series, video games and pop music. Hatsune Miku is known for live performances, in which the avatar is projected onstage as a hologram. In 2018, a Japanese man was reported to have married a hologram version of Hatsune Miku (Japan Times 2018).

Rei Toei can be characterised as a “fictional virtual” character and Hatsune Miku a “real virtual” one, while their counterparts in this schema would then have to be called “fictional real” and “real real”. In summary, I have arrived at multiple realities that must be distinguished by the other sides of their distinctions, respectively.

3.7 Ludus vs. Narratio

In the previous section I have looked at the virtual through the lens of the fictional, crossing distinctions between virtual, fictional and real. By offering my comments on a real debate concerning fictional content, this section examines the distinction fictional vs. real from a different perspective, originating in Jesper Juul's characterisation of games as “half-real”. Juul (2005) is locating the boundary between real and unreal in the distinction between rules and fictional narrative content.

Curiously, this distinction mirrors the rift that the nascent field of game studies has been occupied with from its inception. It is known as the narratology vs. ludology debate (Frasca 1999). The two conflicting positions can be summarised as follows: Narratologists insist that games are instances of the narrative form, comparable to novels, comics and film. Ludologists view video games as a special case based on their interactive, simulative and rule-bound nature (Arjoranta and Karhulahti 2014).

This perceived dichotomy has caused a significant amount of controversy. When Janet Murray (1998) offered a reading of Tetris as “a perfect enactment of the overtaken lives of Americans in the 1990s”, it created a major stir in ludologist circles (Eskelinen 2001). The game, an abstract puzzle whose goal it is to efficiently pack falling shapes together, is considered a prime example for the non-representative and rule based nature of games.

A third faction has emerged that takes issue with the debate itself.¹³ This ranges from the assertion that the apparent differences are not valid (Simons 2007) to the claim that they are based on misunderstandings (Frasca 2003) and from a suggestion for a unification of the positions (Aarseth 2012) to a prominent call to an end of the debate (Murray 2013).

And indeed, one could easily argue against both positions. For one, it appears evident that there are abstract games like Tetris, Solitaire or Chess whose narrative connotations do not play any role in playing the game (Murray 2012). Stories that may have existed in these games are — in Bateson’s words — differences that do not make a difference¹⁴ (Bateson 2000a). An argument against the apparent singularity of games would be that procedural, rule-based and interactive elements can be observed in other forms of art, like performance (compare Andersen and Stott: *Play at Play* (p. 37)) and generative and conceptual¹⁵ art.¹⁶ Phillip Schweighauser notices that narratology as characterised in the debate misrepresents a mainstream position in literary disciplines (Schweighauser 2009).

I conclude from these observations that any definition that aims to separate games from other forms of art based on intrinsic properties of the (art-)work is bound to fail. Can systems theory offer alternative approaches? Galanter (2003) observes generative art from the perspective of complex systems, which stays within the realm of the artefact (compare Luhmann: *Distinctions Create Meaning* (p. 33)). But higher-level observation (see Von Foerster: *Second Order Cybernetics* (p. 29)) enables looking at this debate by asking about its autopoiesis and therefore about its own environment. This opens up new perspectives on the relationships between games, artificial intelligence and the art system (see *Games vs. Art* (p. 63) and *Game AI vs. Playing Machines* (p. 106)) and on the

¹³A confusing aspect here is that critics of the debate (e.g. Espen Aarseth and Janet Murray) are also identifiable as members of one of the opposing camps.

¹⁴Bateson defined the unit of information, as “a difference which makes a difference” (Bateson 2000b, p. 321).

¹⁵For example, Yoko Ono’s *Snow Piece*: “Take a tape of the sound of the snow falling. This should be done in the evening. Do not listen to the tape. Cut it and use it as strings to tie gifts with.” (Ono 1963), cited from (Iversen 2010, p. 98).

¹⁶A common theme between games and procedural concept art is that both utilize the tension between algorithmic determinism and chance (compare Iversen (2010) and Costikyan (2015)).

observation of ludic phenomena in game studies versus in other disciplines (see Play and Discipline(s) (p. 151)).

3.8 The Meaning of “Meaning”

Pre-Socratic philosophy was concerned with the nature of reality itself, an enterprise that has been labelled as ontology. Epistemology then takes into account the relationship between an outer reality and inner knowledge of it (Audi 2002). One prominent example is Plato’s claim that perceptions are literally imaginary and that truth lies in unobservable and abstract ideas (Plato 1984, p. 312-340). In contrast, Aristotle (1998) distinguished between virtuality and actuality and held that the material has the potential to become real.

These concepts already provide a rich landscape for twenty-five centuries of Western philosophy discussing aspects of (non-)reality. The aim of this chapter is to investigate a small subset in their relation to play through mutually crossing distinctions. I will therefore skip some of the grand or vogueish theories that nonetheless provide a background for the present discussion. For instance, Kant postulates that the potential (possible) and the actual represent different modalities that both share the same reality (Kant 2007). Deleuze, on the other hand, proceeds from the Bergsonian concept of virtual (Bergson 2007; Ansell-Pearson 2005), and mirrors Aristotle (1998) in distinguishing between actual and potential. While presenting different positions, these theories still share a definitory stance, their commitment to set down what these concepts “actually are”. In sections Definitions vs. Distinctions: What Is “Is”? (p. 23) and Requirements for a New Paradigm (p. 24) I have indicated that these efforts inevitably run into strange loops and that they can be replaced by constructivist approaches that rely on second order observation instead.

That means that we can opt out of a naïve realism, the metaphysical assumption of an objective reality that “just exists”. By considering the act of perception instead, reality is to be understood as a phenomenon that is mediated through the senses. As discussed in chapter Distinction vs. Identity (p. 15), Maturana and Varela describe perception in organisms as an active process of an autopoietic system rather than the passive experience of a reality as such (Maturana and Varela 1980). The school of radical constructivism took these ideas further, claiming that every contact with reality requires an agent capable of actively constructing the world (see Constructivisms vs. Constructionisms (p. 30)). Both Berger (2008) and Elkins (1997) describe perception in terms of knowledge,

cultural mediation and construction of meaning. John Berger concisely summarises these accounts: “We only see what we look at” (Berger 2008, p. 8). Heinz von Foerster concurs by contributing what he calls the aesthetical imperative: “If you desire to see, learn how to act” (von Foerster 1973).

A place where we can learn to act is Gestalt psychology (Smith 1988), which transfers the idea of self-organised minds into the practical realm, both into perception and into creation in design and art (Seyler 2013). As an example, the figure-ground organisation can be seen as a special case of the operation of drawing a distinction (see Spencer Brown: *Draw a Distinction* (p. 28)): the selection is bistable and the operation of crossing the boundary fluctuates with assigning the borders to either side (Rubin 1921).

Meaning also distinguishes psychic and social systems, which operate with meaning, from biological ones, which do not. An illustration: in an ongoing game (a social system), two minds (psychic systems) are involved, autopoietically forming and processing expectations, thoughts, intentions, while the game communicates. The systems are separate yet structurally coupled: if one of the involved minds would stop operating, the social system would cease to exist. These minds are neither elements nor subsystems of the social system; instead they are located in the environment of the conversation. Minds themselves therefore do not communicate, and they do not transfer information. Rather, they are self-organised, actualising and de-actualising expectations by selecting from potential ones (Luhmann 2002, p. 169-184).

This goes back to the discussion in section Luhmann: *Distinctions Create Meaning* (p. 33). In Luhmann’s terms, meaning is construed as the medium in which systems operate with the distinction between actual and potential. Meaning itself, as a distinction, has the particular property that the other side of this distinction has meaning as well. Even the meaningless and the non-sensical have meaning, which can be playfully expressed (Luhmann 2002, p. 79-93).

3.9 Reality vs. Truth

Another strange loop emerges from a self-reflective angle (compare *A Third Culture?* (p. 149)), by further investigating the question of how statements about reality such as those asserted in this chapter acquire meaning. In other words, how is it possible to separate

true statements from false ones, for example, when I talk about play in this thesis? When I write “play is real” or “play is virtual”, is there an expectation that these observations in principle can be falsified (Popper 1989), and if so, by which means? The answer is surprisingly diverse, as multiple concepts of truth have developed within sciences and humanities.¹⁷

Theories of correspondence go back to Aristotle. They define truth as a particular relation between beliefs or judgements and reality, based on the assumption that mental states represent reality¹⁸ (Russell 2015, p. 100-108). If true propositions depict reality, analytical treatments of language can represent the foundation of knowledge (Ayer 1959). During the 20th century, this approach has come under increasing pressure. Wittgenstein (2007) famously tried to construct a correspondence between language and reality but he renounced this philosophical direction later (Wittgenstein 1958).

In response to growing epistemological problems connected with the assumption of correspondence, various alternatives have been proposed. A particular effort was made to eliminate paradoxes like “This sentence is false”. Tarski (1944) proposed a solution that draws a distinction between object language and metalanguage. It allows statements about truth only in the metalanguage. When I say “all cats are grey in the dark” (Sharman 1874), I am talking in the object language, while the retort “this is wrong”, would belong to the metalanguage. A sentence like “This sentence is false” which includes both language levels would be forbidden — it would be semantically impossible. Tarski’s contribution was originally in the field of formal languages, and indeed it appears artificial. His ontology constructs two realities, one that the object language talks about and a different one in which truth and falsity can be discussed. I have stressed earlier that the capability to observe paradoxes is an essential requirement for a comprehensive description of play (see Requirements for a New Paradigm (p. 24)).

A more radical solution is to claim that the use of “true” and “false” is redundant (Ramsey 1927). In contrast, Strawson (1950) proposed a theory of performance where asserting truth or falsity goes beyond the transmission of information. Instead, it constitutes an expressive act in which speakers affirm their positions. This view is subsumed within systems-theoretic concepts of communication which require the participants to distinguish

¹⁷Here I am summarising truth-criteria as discussed by Seiffert and Radnitzky (1989, p. 369-375).

¹⁸I have labelled this assumption “naive realism” (see Constructivisms vs. Constructionisms (p. 30) and The Meaning of “Meaning” (p. 87)). This concerns positions that accept reality as objective, externally given and non-constructed.

between information and message (Baecker 2013b). Pragmatic theories, e.g. (Peirce 1905) observe truth solely by its capability of producing effects in the world (in Deleuzian interpretation capacities to affect and be affected (Deleuze and Guattari 1987)), thereby avoiding references to elements of psychic systems. This view is compatible with constructivist epistemology (compare Constructivisms vs. Constructionisms (p. 30)). It also directly relates to Peirce's pragmatic understanding of the Virtual as something that has practical consequences "by its virtue". It is however in contrast to the notion of the Virtual as a potentiality that is not actualised (compare Actual vs. Potential (p. 83)). The hostile environment described in section Discussion (p. 42) is virtual in Peirce's sense, as it is a phenomenon that affects people lives. But in the Aristotelean (and Deleuzian) sense discussed in section Actual vs. Potential (p. 83) it is not virtual, as it has been chosen as an actual political measure by the British government.

This is a clear contradiction, a particular problem for theories of coherence which measure the truth of a statement by its fit into related statements. Instead of bridging to a meta-physical realm of reality, the criterion is internal consistency. Difficulties arise, because completely fictional worlds can be — practitioners like Schell (2015) even argue they should be — internally consistent. Thus it is possible to speculate about the epistemological status of Nathan Drake, the protagonist of the Uncharted games (Straeubig 2016c), or to discuss the physics of Star Trek (Krauss 1997). Fictional contents bleed into the real world in various ways, through alternative realities (compare Actual vs. Potential (p. 83) and Magic vs. Pervasive (p. 128)) or, for example, by contemplating the question if the game *Pokémon Go* (Niantic 2016) can be considered feminist (Assuncao 2018) in terms of Bruno Latour's actor-network theory (Latour 2005; Latour 1998).

Theories of consensus define truth as the agreement of a majority or at least of a significant number of proponents. If enough people decide to construct a reality from the Star Wars franchise by declaring their religion as Jedi, for example, the established political and religious social systems are forced to address this irritation (compare Luhmann: Distinctions Create Meaning (p. 33)). Possamai (2005) analyses this phenomenon of the Jedi census as an example of hyper-real religions, in other words: simulacra of simulation (Baudrillard 1994, p. 121).

Whereas constructing truth by consensus seems fitting in postmodern conditions (Feyerabend 2010), the lack of objective grounding raises another set of problems. Psychological

experiments demonstrate how group pressure caused people to agree to objectively wrong answers (Asch 1951), although there is evidence that this result does not describe psychological but sociological effects (Bond and Smith 1996). I will pick up on the significance of the environment in chapter System vs. Environment (p. 123).

3.10 Exploring the Virtual

I have started this chapter with a critique of virtual reality through my own practice and went on to discuss the distinction between virtual and real by visiting different meanings of “virtual” and of “real”. Yet I arrived at the meaning of “meaning”: a strange loop that appears to emit the virtual odour of Magritte’s pipe (Magritte 1929). Armed with an understanding of virtual reality as a medium that is capable to convey meaning, I now return to the side of practice and observe scientists and artists that are making use of VR as an instrument of exploration, in particular to query and challenge the distinction between distinction and identity (compare Distinction vs. Identity (p. 15)).

The Machine To Be Another by BeAnotherLab (Bertrand et al. 2014) is a playful take on human perception based on the distinction between Alter and Ego, the participants in communication (Luhmann 1996, p. 137-175). The visual input of two persons wearing VR headsets and cameras directed at their own bodies is swapped by routing it into the respective other headset. The participants are encouraged to touch themselves, experiencing the mismatch between their visual and haptic perception. Ego is directing Alter’s gaze and vice versa while they both feel their own bodies. Here, the players and the virtual reality apparatus constitute a socio-technical system with the virtual as a medium through which the players’ perception is guided. With their artist-driven, interdisciplinary research, BeAnotherLab is investigating issues such as the refugee crisis, mother-child relation and psychological disorders (Bertrand 2019).

In the context of virtual reality, the question of empathy has been discussed extensively, especially after it was touted as “a machine that makes us more human” by Chris Milk (2015). And indeed there is a growing body of research into the question of whether specifically designed virtual experiences can enhance the ability to understand and sympathise with feelings of other people. Archer and Finger (2018) present short 360-degree videos in a VR headset, on a desktop and for control in form of text and images. Then they collect self-reported items that they attempt to relate to empathy: a sense

of presence, the ability to take another perspective, and the likelihood of taking action after the experience. In their experiment, the factors that were positively correlated with immersion were: novelty, pleasant visuals, focus on one protagonist, and trust in the narrator. They also found a correlation between the level of immersion and the subsequent motivation to take action. Both modalities in virtual reality received a higher empathic response than the illustrated text, which in turn positively affected memory and curiosity about the subject. However, the perceived interactivity and presence did not show a significant difference between the headset and the desktop variant.

Similar results from Herrera et al. (2018) confirm that immersion in virtual reality can promote empathy. They report longer-lasting positive attitudes and a significantly higher willingness to take action compared to perspective-taking tasks, which ask participants to imagine being someone else in specific situations. Shin (2018) links pre-existing traits, presence and flow to empathy and embodiment whilst van Loon et al. (2018) stress the importance of presence and target specificity. The latter experiment found no increase in pro-social behaviour, however, which challenges the correlation between empathy and congruent action. Note that in these scientific studies, the distinction that Archer and Finger (2018) label “immersive versus non-immersive format” is purely technical: head-mounted vs. desktop-based virtual reality. We know nothing about the storytelling, or the visual and auditory qualities of the experiences. This would require to cross the distinction between art and science or between theory and practice (compare Theory vs. Practice (p. 149)).

Francis et al. (2017) analyse moral actions through the example of the trolley problem (Foot 2002), comparing a VR version with a text-based questionnaire. In the Trolley Problem, participants face a dilemma where they can push a man in front of an approaching train to save the lives of a group of people on the tracks. The outcome is a higher propensity for utilitarian responses in VR, pushing the man over the bridge, than in the questionnaire condition. Variants of this thought experiment have been studied extensively. They also are applied to ethical questions about autonomous cars (Keeling 2017). Despite their apparent fictional nature, (im-)moral actions in games have raised significant concerns and controversies (see Play vs. Dark Play (p. 67)).

Despite the corroborating evidence, the idea of VR as a vehicle for empathy has attracted criticism, notably by Bloom (2016). However, Bloom is attacking the prevalent notion of empathy itself, suggesting traits such as reasoning, kindness, self-control and compassion

as preferable alternatives. In this approach, he draws a conceptual distinction between immersing oneself in somebody else's shoes ("emotional empathy") and a rational, measured responses ("cognitive empathy"). In line with the studies cited above, emotional empathy is biased towards individual fates, in lieu of being able to empathise with a larger population and the greater good. Furthermore, according to Bloom, empathy can cause distress, pose a risk factor for burnout and "lead people to avoid situations that would trigger such distress" (Bloom 2017, p. 28).

Slovenian philosopher Slavoj Žižek, quoted at the beginning of this chapter, goes further in his critique by drawing a distinction between virtual reality, which he characterises as an artificial digital reproduction of the ordinary experience of reality and the reality of the virtual, bringing Lacanian psychoanalytic analysis into play. His outspoken verdict of virtual reality as "a rather miserable idea" (Žižek 2012, p. 3) rests on the argument that a more interesting direction than simulating reality in an artificial medium is to investigate the effects and consequences — the reality of the virtual (see Actual vs. Potential (p. 83) and Reality vs. Truth (p. 88)).

We can attempt to step into somebody else's shoes, I argue, and the "other" does not necessarily have to be human. This is demonstrated by the VR artwork *In the Eyes of the Animal* by Marshmallow Laser Feast (2016). Here a distinction is drawn between the modalities of human and animal perception. Marshmallow Laser Feast aim to create an immersive environment for humans that transfers animal perception into a virtual experience (Straeubig 2016i). While the depiction of the perception of the individual animals in this project is based on sound research, the results are shaped by artistic interpretation.

In a widely discussed essay, Thomas Nagel (1974) asks: "What is it like to be a bat?". Nagel's answer contains a strong argument against objective, reductionist views of consciousness: it is impossible to know. While we are able to imagine being bats, we cannot experience the experience of another creature in its full extent. A bat primarily perceives the world through echo-location with its highly sensitive sonar. Its entire sensory apparatus and its brain are radically different from ours; and so, presumably is the inner life of a bat. This echoes Maturana's thesis of structural determinism (see Maturana and Varela: Perception Is Distinction (p. 32)).

In the Eyes of the Animal is designed as an immersive experience: when we put on

the helmet, we enter a virtual environment that allows us to explore the perceptions of the inhabitants of the forest. However, Nagel's argument has not been refuted. We do get a glimpse of what it is to be an animal, but we are not confronted with a realistic experience. Still, Nagel's on-point scepticism should not be read to discourage artists and designers from exploring the perception of "otherness", be it sensory, psychological or conceptual. On the contrary, for every objection, the art system invites an "even more so" (see Games vs. Art (p. 63)). Jane Gauntlett's *In My Shoes* represents such an attempt to "communicate the incommunicable" (Gauntlett 2011). She thematises an assault that left her with traumatic brain injury, coma and epilepsy. *Labyrinth Psychotica* by Jennifer Canary Nikolov(a) (2016a),¹⁹ also described in her thesis (Canary Nikolov(a) 2016b), confronts the viewer with psychosis, while *Notes on Blindness: Into Darkness* by Arnaud Colinart (2016) explores the "world beyond sight". It is based on the audio diaries of John Hull (2013), who lost his sight in the early 1980s.

Other projects like the audio-only game *Papa Sangre* by Somethin' Else (2010) and the immersive environment *Haptic Field* by Chris Salter and TeZ (2016), as well as artists like Peter Weibel, Ruth Schnell and Anke Eckardt experiment with virtuality, digital synesthesia and perception (Gsöllpointner 2015). When we even cross both the boundary from art towards science and the one from human to animal experience, we can even arrive at experiments that construct a virtual reality for fruit flies (Dombeck and Reiser 2012).

All these projects operate with the first person perspective, communicating perceptions through perceptions. In Luhmann's theory, this is the mode of communication of art-works (Luhmann 2000). On the other hand, art is also a social system. On this level, *NeuroSpeculative AfroFeminism* by Hyphen Labs (2017) challenges the predominantly western mainstream of VR production through the lens of speculative design, feminism and afrofuturism (Dery 1994). It also reminds us that virtual reality is a medium, and located in its environment are other social systems within a wider culture.

3.11 Summary: Half-real

Given that the questions about truth and reality discussed in the previous sections touch on traditional ontological and epistemological problems, I cannot expect to "solve" the gaps and contradictions between the manifold constructions of reality. In chapter Distinction

¹⁹This spelling of the artist's name is deliberate.

vs. Identity (p. 15) I have laid out foundations for observations of play that are based on distinctions, constructivism and observation. The goal of this chapter was rather to observe the conceptual landscape and notice the strange loops on the way²⁰ (see What Is Play? (p. 15)).

Using distinctions as instruments, I have observed how I and others observe play in its relation to realities and non-realities. To include the first and third person perspective, as I have called upon in section Requirements for a New Paradigm (p. 24), I augmented “an observing science” (Glanville 2001) with an “observing practice”. My point of departure was a critical and practical investigation into the concept of virtual reality through a series of workshops based on an attitude of imperfection. I then examined virtual reality beyond its narrow technological interpretation and investigated a complex conceptual landscape where issues of perception, fictionality, imagination and truth could be discovered through the lens of distinctions. In particular, I have looked at the following concepts: virtual, real, actual, potential, imaginary and fictional and discussed some differences they make for play.

In the next chapter I will change the perspective again and shift the observation to — as some would say — the central aspect of play²¹ that I have largely omitted so far, the player.

²⁰Having used terms like “objective truth” and “evidence” in this chapter, it is likely I have created more of them.

²¹With the constructivist methodology laid out in chapter Distinction vs. Identity (p. 15), there are no innate central concepts. Each aspect of play can become central for an observer simply by selecting it. This is analog to a successful characterisation in a film script, where secondary characters should not know that they play a lesser role, according to (Howard and Mabley 1996, p. 63-65).

Chapter 4

Human vs. Machine

Man only plays when in the full meaning of the word he is a man, and he is only completely a man when he plays.

Friedrich Schiller (1795)

4.1 Can Machines Play?

Is play the culmination of human essence as Schiller had proclaimed? How can this declaration be reconciled with play behaviour observed in animals? And finally, in which sense do non-biological entities — like machines¹ — play? In this chapter I observe a new set of distinctions by turning my attention towards the playing subject.

To explore my speculative question as to whether machines can play, I will first cross the distinction between humans and machines with the distinction between playing and thinking. On May 15, 1951, Alan Turing (1951) delivered a talk on BBC Radio 3 with the title “Can Digital Computers Think?”. In this talk, as well as in the paper “Computing machinery and intelligence” published one year earlier, Turing (1950) not only discusses whether machines can think, but he also suggests a particular way to find an answer. Acknowledging the difficulties that arise when trying to define “machine” or “thinking”, he instead suggests the staging of an “Imitation Game” as a criterion for machine intelligence.²

¹I will be using the term “machines” to denote non-biological entities including physical apparatuses as well as algorithms and I will indicate where this difference makes a difference, for example in the context of embodiment.

²Turing describes a situation in which an interrogator is in a conversation with a man (A) and a woman (B), whose identities are hidden. The man is instructed to cheat, while the woman gives honest answers. Through the exchange of written or typewritten questions and answers alone, the interrogator tries to identify who is who. Turing then suggested to replace the man with a computer: “We now ask the question, ‘What will happen when a machine takes the part of A in this game?’ Will the interrogator decide wrongly as often when the

During the second half of the twentieth century, Turing's question became seminal in the emerging disciplines of cognitive science and artificial intelligence.³ While the adequacy of the Turing Test has been challenged from various angles (Hayes and Ford 1995; Searle 1980) and many alternatives have been proposed, I believe in the unabated value of Turing's methodological approach: to explore and operationalise a research question while avoiding to base it on definitions (compare Definitions vs. Distinctions: What Is "Is"? (p. 23)). Gigerenzer and Goldstein, tracing the history of the mind-as-computer metaphor, stress the central role of tools in the genesis of scientific theories about the mind. In their tools-to-theories heuristic they describe how scientific tools like techniques, methods, apparatuses and algorithms initiate new scientific metaphors and concepts and that these concepts are more likely to be accepted if the scientific community is also using the tools (Gigerenzer and Goldstein 1996) (compare Play and Discipline(s) (p. 151)).

In the 1950s computers were not the "smart" ubiquitous devices we carry in our pockets today, but bulky, room-sized machines that rattled and hummed with electromechanical relays and glowing vacuum tubes. Although the early "electronic brains" already demonstrated superhuman powers in mathematical calculations, the association of those curious contraptions with more general cognitive capacities must be considered a lot more imaginative than it would be today. And while the debate about how to evaluate the progress of artificial intelligence is ongoing (Hernández-Orallo 2014), a majority of experts in the field show confidence that the construction of machines with general "human like" intelligence can be achieved within a foreseeable future (Müller and Bostrom 2014). While Turing's question "Can Digital Computers Think?" has not been answered yet to the complete satisfaction of all AI researchers, it has inspired researchers and facilitated academic debates for decades (Saygin, Cicekli, and Akman 2003).

This fruitful development prompted me to think about an analogous question applied to play and playful behaviour. Therefore, I am going to speculate about whether machines can play (and to explore what that question means), mirroring Turing's line of argumentation (Turing 1951). Accordingly, I will initially offer two immediately obvious answers that are contradicting each other.

The first answer is that machines can play; as evident from each game of chess that we

game is played like this as he does when the game is played between a man and a woman? These questions replace our original, 'Can machines think?'" (Turing 1950). This procedure is known as the "Turing test".

³The term "artificial intelligence" was introduced by John McCarthy and Marvin Minsky at the Dartmouth conference in 1956 (Gardner 1998).

play with a computer. It seems almost an irony that a major area of application for artificial intelligence has been the creation of opponents and non-player characters for computer games: the science of artificial thinking is concerned with artificial playing (see Game AI vs. Playing Machines (p. 106)). Play, understood as a pattern of social interaction, accepts machines as playmates, not only machines imitating humans but also humans imitating machines (Standage 2003). When we play with a computer, actual cognitive capabilities, let alone consciousness, are not required for the machine — the experience (or illusion) of intelligent behaviour is sufficient, just like in Turing's imitation game.

The second immediate answer to our question is negative. Machines, as far as we understand them, lack the sensual, the emotional, and the aesthetic dimension of human experience, which includes the experience of playing or being playful. In analogy to an argument from Thomas Nagel's thought experiment about the phenomenology of a bat (compare Exploring the Virtual (p. 91)): as long as the machines are not structurally indistinguishable from us, they will never be able to experience "what it is like to play" (Nagel 1974).

In the Western cultural tradition, this standpoint is highlighted in Friedrich Schiller's characterisation of play as the essential quality of a human being, quoted at the beginning of this chapter. In his treatment of play, according to Sam Gill, "Schiller avoids the trap of so many modern understandings of play by appealing to a common understanding that it is neither subjective nor objective, that is, play is not distinguished as state of mind or attitude, nor as a particular set of actions or objects" (Gill 2012). Instead, Schiller explains play through the *Spieltrieb*, a play drive that serves to reconcile the other drives, mediating between sensation and rationality. Sutton-Smith (1997, p. 127-150) objects that Schiller's "rhetoric of the imaginary" does not encompass most forms of play deemed mundane from its idealistic perspective.

It is important to note that the two opposed answers given above can be traced back to the fundamental division between the third person perspective and the first person perspective, which is at the heart of the philosophical debate about the mind (see Paradoxa of Play (p. 69)). Judging from observable behaviour, we concede that machines are capable of playing, while from *their imagined* subjective experience we deny machines to be playful. This leads to the intuition that a full understanding of play might have some characteristics of the "hard problem" of consciousness (Chalmers 1995).

How could a condition for the possibility for play look like from a systems-theoretic perspective? I argue that the machine must be able to act as an observer and to draw distinctions between itself and the other and between message, information and understanding (Baecker 2013b). On this foundation, a machine that is able to observe and to form expectations (see Game AI vs. Playing Machines (p. 106)) will also be able to take part in communication. While for Luhmann psychic systems are independent yet structurally coupled with social systems (Luhmann 1996, p. 210-277), I believe that in general minds (as well as brains) are not a necessary condition for participating in social systems (compare New Social Systems (p. 161)).

This means that we can begin to shift our attention away from speculating about conscious machines (Kurzweil 2014) and from trying to build bottom-up biologicistic simulations in the hope that something will emerge (Eliasmith 2013). Yet the latter is exactly what I attempted to create — and failed to achieve — in my project *neurotic*, which I will discuss in the next section.

4.2 Project: Neurotic

Neurotic (Straeubig 2014d) uses a model of spiking neurons that generates sound using the physical locations of the players. It shares the technical basis with *KlingKlangKlong*, the locative experience I designed for human and non-human players (compare Project: KlingKlangKlong (p. 110)). *KlingKlangKlong* is a laboratory of ideas that led me to the concept of anthroponeutral play design, a methodology that explores the distinction between humans and machines by making it invisible (see Anthroponeutral Design). Conceptually, *neurotic* was an attempt to play with ideas about the brain. As discussed below, ultimately I did not pursue this direction further. However, it has informed my research into biological systems and their relevance to my developing ideas about play.

4.2.1 Development

I developed *neurotic* by adding an implementation of a model of biological spiking neurons based on Izhikevich's model described in (Izhikevich 2003) to *KlingKlangKlong*. At first I re-implemented the original Matlab code in Processing and validated the output visually. To implant the spiking neuron behaviour into the virtual players, I then translated the code

to JavaScript and integrated it with the existing modules.

In *KlingKlangKlong*, an event is triggered when the timeline of the sequencer hits a player's virtual position (compare Project: KlingKlangKlong (p. 110)), generating one of three preconfigured synthesised sounds. In *neurotic*, the timeline stimulates the artificial neurons instead. Sound is then triggered by the firing patterns of the neurons.

During the development of *neurotic* I encountered a number of technical challenges. Despite the simplicity of Izhikevich's model, it adds significantly to the strain on the limited computational resources of the browser-based application running on a smartphone.

4.2.2 Exposition



Figure 4.1: Neurotic at Prototype Dublin

I showcased *neurotic* at Prototype, an experimental games festival curated by Hilary O'Shaughnessy that took place in Dublin in October 2014. *Neurotic* ran for the course of a weekend in the context of other playful interventions, talks and urban games. I presented it again at the Mediacity 5 conference in May 2015 at the University of Plymouth.

I set the project up as a self-service interaction, available during the whole time of the festival. I provided a set of instructions on a printout and installed a tablet that ran the web-based *neurotic* app. To start the experience, participants scanned a QR code or entered the application's web address into the browser on their smartphones. Then they went outdoors and engaged with the emerging dynamic system.



Figure 4.2: Neurotic at Mediacity 5, University of Plymouth

I also participated in the experience while I observed players interacting with *neurotic*. Some players were seeking to create musical structures, while others were meta-gaming, chasing each other through the centre of Dublin. As a participant myself, my own observation, for example moving after players, inevitably changed the pattern of the soundscape. Often I steered toward players to determine if they were virtual or physical. As my interface was the same as all the other players, I could not determine if players were human or virtual, and I had to identify human players by spotting them in the street.

4.2.3 Discussion

Do brains play? Or, from the perspective of a brain, how does it experience play? Does a brain enjoy playing? Questions like these may come to mind, when we try to understand a biological system.

During the course of developing *neurotic*, I was pursuing different threads of inquiry. One direction was to research into the neurobiology of play, especially Jaak Panksepp's approach to locate play in the deeper structures of the brain⁴ (Siviy and Panksepp 2011).

Another fundamental source of inspiration comes from artistic projects, here in particular from *The Fragmented Orchestra* by Jane Grant, John Matthias and Nick Ryan⁵ (Grant,

⁴I think that I had misread Panksepp at that time, because I understood his thesis as play being more fundamental than other basic functions, however now I would summarise his theories that play as well as other basic affective neurological functions are located in deeper parts of the brain than previously assumed.

⁵Both Dr. Matthias and Dr. Grant are supervisors for this thesis.

Matthias, and Ryan 2008a). An integral part of this project is the *Neurogranular Sampler* (Grant, Matthias, and Ryan 2008b), a virtual instrument that processes input signals through the model of a spiking neural network to activate a granular sampler (Miranda and Matthias 2005). Unlike other, more abstract models used in machine learning techniques, spiking neural network models add expressiveness as they operate on the spatio-temporal relations of nervous excitation (Gerstner and Kistler 2002). Their simulation, however, requires significant computational resources (Izhikevich 2004). A particular model developed by Izhikevich is able to produce different firing patterns that have been observed in neurons from a small set of parameters (Izhikevich 2003). The *Neurogranular Sampler* and *neurotic* both use this model, independently implemented and with different results.

My second aim was to foster the understanding of play from a transdisciplinary perspective (compare Requirements for a New Paradigm (p. 24)). The CogNovo doctoral program has exposed me to a wide range of theories, methodologies and practices through several week-long workshops with representatives of various disciplines (see Published Work (p. 9)).

As a result of discussions with three of my fellow doctoral candidates, Pinar Oztop, Chun-Wei Hsu, Mihaela Taranu and I co-authored a common paper about play (Straeubig, Hsu, et al. 2016). In our paper we observe play from perspectives of neuroscience, deception, creativity and systems theory. Each part is written by one of us and closes with some fundamental questions about play.⁶

Our first question is about the significance of research in play. If play is biologically more fundamental than non-play, resonating with Panksepp's deep structure hypothesis, we ask, should cognitive science and artificial intelligence focus more on play as areas of research? In particular, the field of machine learning has seen rapid development in this area which I will discuss in the remainder of this chapter (see Game AI vs. Playing Machines (p. 106)).

Another question is concerned with the relationship between play and creativity. How are they related? Can play be uncreative? Is it possible to bring these two highly complex constructs closer together (compare Play vs. Learning (p. 56))?

If play always has a purpose, which biological, psychological or sociological benefit would

⁶As those questions reflect larger threads of investigation in this thesis, they are presented here in an edited and commented form compared to the original paper.

play that involves unpleasant, dangerous or otherwise detrimental behaviour entail (see Play vs. Dark Play (p. 67))? On the other hand, how can we interpret the hypothesis that play has no function apart from itself (see Play vs. Purpose (p. 54))?

Questions like these, arising from transdisciplinary processes, by first observing and discussing disciplinary findings, and then reframing them from different perspectives, have guided my research. Moving from the social system level to the biological one (compare Luhmann: Distinctions Create Meaning (p. 33)) requires the adoption of significantly different distinctions that pertain to phenomena like synaptic transmitters, firing patterns or the connectome. To convey information, these differences must make a difference (Bateson 2000a), a principle that also applies to my practical approach. Therefore the question can be asked: in which respect did *neurotic* make a difference for my project?

I had been struggling for some time to find adequate approaches towards incorporating the brain as a subject of my research in play. *Spiel 1*, my playful performance that operates with brain signals, is a satirical take on scientific and moralistic purpose in the context of serious games (see Discussion (p. 59)). *Neurotic*, on the other hand takes the direction of simulating a biological system. Technically, it extends *KlingKlangKlong* by planting a small number of spiking neurons into the virtual players. Apart from that difference it did add not a new quality to the system.

Conceptually, the project took me deep into specialisation — it did not produce sufficient *Anschlussfähigkeit* for investigating play in a comprehensive manner as discussed in section Requirements for a New Paradigm (p. 24). Thematic connections like plasticity, noise and polychronisation already had been pursued before (Matthias 2013). The integration of this fundamental biological model into my existing project however did not create a “difference that makes a difference”, besides quickly draining the players’ batteries.

In the meantime, my project had already taken a direction that called for observing and designing for a more general set of distinctions, such as system vs. environment and virtual vs. real. Instead of looking through a microscopic lens zooming in on a specific aspect of play, I began to zoom out into a macroscopic view, looking at a multitude of aspects, albeit through a specific methodology.

Referring back to section Luhmann: Distinctions Create Meaning (p. 33), this allows an answer to the initial question in this section. From the systems theory perspective, the

answer is unambiguous: it would be a category mistake to claim that a brain can play. It can't. Brains do not experience anything. These heavily innervated organs are biological systems that operate with electrical signals and chemical processes. A neuron fires or it doesn't, a synapse is transporting transmitters, a glial cell supports the neuron by taking care of its nutrient cycle. The brain doesn't play, and it doesn't think either (Noë 2010).

Representatives of cognitive neuroscience that put the brain at the center of their ontology might find this observation disappointing (Eliasmith 2013). Yet we gain the ability to observe distinctions between biological, psychic and social systems. This allows us to progress towards a comprehensive description of play without recourse to simple metaphysics or reductionism⁷.

For me, *neurotic* was for me an important step towards non-human play, an attempt to play with the idea that play can be observed on the level of biological systems. It was inspired by research into neuroscience, but it has contributed to my investigation of playful experiences in non-human entities. During its development, I was beginning to challenge my own system-theoretic assumptions through a practical yet speculative approach (Dunne and Raby 2013). I was asking questions such as "What would be a playful experience for a neuron if it could have one?" and "How would I design one?". By following these questions I was creating a virtual space for design (compare Virtual vs. Physical (p. 79)) in which I could revisit and revise my assumptions discussed in Distinction vs. Identity (p. 15).

In the end I did not come up with games designed for neurons. Instead I took away three realisations that would guide my further work. Firstly, the anthropomorphising language of science plays a crucial role for an observer. When neurons are described as excited, the technical term describes an electrical activity (Izhikevich 2007), however for me it is almost impossible to avoid reading an emotional quality into it. In response, I began to reflect on biological metaphors and developed a stance towards superseding anthropomorphism which I have called "anthroponeutral", in distinction to the term "anthropocentric" (see Anthroponeutral Design (p. 157)).

A second understanding that began to develop in this phase concerns the relation between theory and practice. My projects took on the role of tools to inform my theoretical work while the theory would inform my projects. This became clear to me in the process of moving from game design to design for artistic research (compare Mateas and Schwab:

⁷In section Counterpoint: Machines Play (p. 118), I will engage in some metaphysical speculation in the context of the likewise speculative research question if machines can play.

Artistic Research (p. 38)). I started to observe and construct my practical work, my writing and the existing literature as artistic laboratories through the lens of distinctions.

This topology of concepts can again best be described as a strange loop (see *What Is Play?* (p. 15)), in which practical projects re-appear in theoretical distinctions and vice versa. The material for this loop, imagined in its physical manifestation is constructed from Brooks' *Nouvelle AI*, Matejas' expressive AI (see Mateas and Schwab: *Artistic Research* (p. 38)) and Schwab's artistic research through exposition (see Schwab: *Artistic Research and Exposition*). In a traditional sense *neurotic* is a dead-end project that I would have considered a failure, yet it has contributed to a large extent to the direction of my overall project, more than some of my more developed projects.⁸

The third insight led me to critically re-examine Luhmann's categorisation of machines, biological, psychic and social systems (see Luhmann: *Distinctions Create Meaning* (p. 33)), and in order to understand play in a comprehensive manner, I had to ask what it means to take part in social systems of play. By bringing a distinction of distinctions into play, system vs. environment as opposed to system vs. element, it became clear to me that instead of investigating parts of a system (such as neurons), I would observe systems (such as machines) that were in Luhmann's schema located in the environment of social systems. I saw the rapidly shifting roles of machines with respect to play (see in particular *Game AI vs. Playing Machines* (p. 106)) as an encouragement to pursue this route. During this process I shifted my investigation from the question "can neurons play?" to "can machines play?". This perspective of play provides the context for the next section, in which I will ask about the role of the non-human player.

4.3 Game AI vs. Playing Machines

One of the two contradicting answers to the question of whether machines can play that I gave in section *Can Machines Play?* (p. 97) was based on the observation that humans and machines have been playing together for a long time. Mechanical automata, toy robots, scary puppets appearing on ghost trains, pinball machines, chess-computers and non-player characters in video games are just a few examples of the wide variety of machines that have been involved in human play.

⁸I am discussing further aspects of the distinction between theory and practice, especially its relation to academic disciplines in chapter *Theory vs. Practice* (p. 149).

Norbert Wiener had pondered the question of how to construct an automaton that plays chess on a level between merely abiding by the rules and the theoretical optimum. Wiener (2007, p. 193) thought that the machine should offer an “interesting opposition to a player [...]”, while adapting to different strengths of its human opponents. Thus the cybernetic opponent, as depicted by Wiener, is designed to challenge the player, not to solve an algorithmic optimisation problem. In the words of Andrew Pickering (2011), it stages an ontological theatre: performative, not representative. This is different both from cognitive sciences that attempt to represent the human mind and from engineering which constructs game playing agents based on the goal of optimisation (Shannon 1950; Simon and Chase 1988).

Seventy years after Wiener’s conceptualisation, a thriving subset of AI research is concerned with computer games (Yannakakis and Togelius 2018) while a subset of this subset is concerned with the construction of believable opponents that provide “interesting opposition”. These approaches operate both on the level of behavioural (Karpov, Schrum, and Miikkulainen 2012) and functional (Schrum, Karpov, and Miikkulainen 2012) descriptions. Their criterion still tries to measure how believable the non-human players appear to the human players (Hingston 2012). This is in essence the same practical approach that a game designer would pursue (Schell 2015).

We can understand these efforts as literal translations of the Turing test (see *Can Machines Play?* (p. 97)) into the environment of games (Livingstone 2006). Both processes display structural similarities (Hingston 2009) which are related to attempts in modelling creativity and learning in artificial intelligence.

Zook, Magerko, and Riedl (2011) describe an implementation of pretend object play (compare *Real vs. Imaginary* (p. 80)) with their cognitive architecture *SOAR*. The system distinguishes between a “pretend domain” and a “real domain” which share common structures for communication and reasoning. It is based on the theory that “pretend play is ‘metarepresentational’, in such a way as to require the pretender to represent their own or another’s representation of a counter-factual state of affairs” (Jarrold et al. 1994).

In sections *Play vs. Purpose* (p. 54) and *Play vs. Learning* (p. 56), I have observed the distinctions play vs. purpose, playful vs. serious and autotelic vs. heterotelic. Adding more distinctions, human vs. machines, third person vs. first person perspective (see *Paradoxa of Play* (p. 69) and *System vs. Environment* (p. 123)), I am now able to describe machines

that are learning in the eyes of their researchers while they are playing in an autotelic manner as systems within a playful environment⁹.

Mnih et al. (2013) go a step further into the cognitive domain by requiring the computer to detect and learn the mechanism of the game through observing raw pixel values. Their “deep learning” architecture is based on multiple layers of self-organising artificial neural networks (Hinton, Osindero, and Teh 2006). The output of the network is a value function estimating future rewards. This enables the system to play not only a specific game but a range of different ones. The questions then become: What is the system programmed to do? Is it programmed to play? Is it programmed to learn? Or even: is it programmed to draw distinctions?

Mnih’s result is part of a remarkable development in game-playing AI. After achieving and surpassing human-level play in Backgammon and Chess, the game of Go, previously thought as combinatorially out of reach for some time, was conquered by a combination of stochastic search and self-optimising learning strategies (Sutton and Barto 2018). Subsequent iterations of the algorithm dubbed *AlphaGo* (Silver, Huang, et al. 2016), *AlphaGo Zero* (Silver, Schrittwieser, et al. 2017), and *Alphazero* (Silver, Hubert, et al. 2018) beat the previous ones without recurrence to actual game data. Research is now branching out into virtual environments such as realtime strategy games (Font and Mahlmann 2019; Vinyals et al. 2019), and animal Olympic Games (Crosby, Beyret, and Halina 2019) and hide-and-seek (compare Play and Discipline(s) (p. 151)).

Justesen, Debus, and Risi (2019) caution against overly optimistic interpretations of the results that are reported for game playing AIs. Some of the accomplishments recorded for artificial agents competing with humans, they argue, are due to methodological issues in the design and evaluation of fairness in competitions.

According to Guckelsberger et al. (2017) it may be possible to develop artificial game-playing agents that feature a computational model of intrinsic motivation that allows them to predict the player experience in procedurally generated environments. The gameplay data collected from human players has been shown to be correlated with motivational factors of player experience such as competence, autonomy, relatedness and presence (Melhart et al. 2019).

⁹I have previously suggested that a certain complexity is needed to describe complex phenomena such as play with sufficient precision (see the second requirement in Requirements for a New Paradigm (p. 24)). The explicit observation of these six distinctions, I contend, provides an example for this postulate.

Designer Jason Huggins (2012) is teaching a machine how to play, with the additional aspect of embodiment. The input is again the camera image from the game and the output robotic arm movement, almost from the perspective of a human player. Ironically, this project has a non-playful purpose, it is designed for automated user testing.

An embodied, virtual and fictional (see Virtual vs. Fictional (p. 84)) perspective is taken by Jiang and Saxena, who let robots insert virtual humans into a room geometry provided by their sensor data, and infer from synthetically generated movements of those “imagined” humans possibilities for placing objects (Jiang and Saxena 2013). In their paper titled “Hallucinating humans for learning robotic placement of objects” they are explicitly referring to object affordances (Gibson 1977). Wells (2002) argues for a perspective on affordances that links ecological psychology and formal computational models (see also What Surrounds Play? (p. 123)). Gaina, Lucas, and Perez-Liebana (2019) contend that a system should learn through continuous interaction with human players. Their proposed approach is comprised of several modules that combine planning and learning to improve its performance.

In all these examples, machines are playing from the scientific point of view and for the advancement of science (see Play and Discipline(s) (p. 151)): they pretend, learn, imagine and motivate themselves with and through play. I want to revisit the distinction between play and purpose for a different kind of playing machines, those that are relocating boundaries between humans and machines in liminal, surprising and artistic ways.

Rube Goldberg machines are mechanical devices that exemplify Suits’ definition of play (see What Is Play? (p. 15)) by eschewing efficient means in favour of less efficient ones (Berry and Goldberg 2001). Bruno Munari’s *macchine inutili*, useless but expressive machines (Antonello 2009) and Jean Tinguely’s noisy, rattling installations (Tinguely 1978) exhibit aesthetic qualities of machines devoid of external purposes and productivity. This autotelic quality was apparently also present in Ross Ashby’s *Homeostat*, a cybernetic device characterised as “unpurposeful machine” by Norbert Wiener (Pickering 2011, p. 105). Likewise, Julia Zamboni’s *Robot Ludens* (Zamboni 2017) explores and exhibits playful machines. Humour, fun and play in the context of software and algorithms are also discussed from a multitude of perspectives in (Goriunova 2014).

New kinds of social systems (see New Social Systems (p. 161)) have appeared as well. *Umbilical Digital*, a cybernetic installation by Dmitry Morozov (2018), shows a machine

that cares for Tamagotchi. *Techne* is a community of synthetic artists that produce artworks and critique each other's results (Pagnutti, Compton, and Whitehead 2016). In the piece *The New Artist* by Axel Straschnoy et al. (2008) a robot that is producing art is complemented by a second robot watching the process. Human spectators are observing the machine audience which in turn observes the machine artist — we are in the process of becoming second order observers. This points to a direction in which interactivity is replaced by interpassivity, delegating the effort of play to machines (Fizek 2018). My ongoing project *KlingKlangKlong*, discussed in the following sections, aims to investigate these anthroponeutral perspectives (see *Anthroponeutral Design* (p. 157)) by inviting humans and machines into a common playful environment.

4.4 Project: KlingKlangKlong

KlingKlangKlong is a work in progress locative multiplayer interaction designed for human and non-human players (Straeubig 2014c). The human players move around outdoors within a bounded geographic area. They are equipped with smartphones running the *KlingKlangKlong* web app, which is linked to a central server over an internet connection. The players' locations are monitored by the GPS receivers on the phones, periodically transmitted to the server and distributed to the other players. Latitude and longitude values are translated into a normalised virtual space. This space is shared with a number of virtual players that are created when a play session starts. Virtual players move with the human players within the virtual space, and they can be spawned and removed during a session. A third type of entities, to be added later during development, are reward objects which are placed into the space at random and do not change their location during a session.

The number of players can be configured in the parameters of *KlingKlangKlong*. Through experimentation I settled on a fixed number and added a mechanism that automatically adjusts the number of virtual players based on the number of human players. Therefore *KlingKlangKlong* can be played alone. Actually it does not require any human players at all (see Discussion). The algorithm removes a virtual when a human player enters the playing area and adds a virtual when a player leaves.

The size of the area in which a *KlingKlangKlong* session is run depends on the number of players. As a rule of thumb, human players should be able to move around without

necessarily seeing each other most of the time. They should be able to follow each other and meet. In practice, I chose approximately a square kilometre for 5–10 players. A play session is not time limited; as long as the server is running, players can drop in and out any time.

Virtual and human players receive the same location data. For the human players, the locations are translated into sound. This is accomplished through a spatial metaphor similar to a pattern sequencer.¹⁰ One dimension (the y-axis) translates into the pitch of the sound while the other dimension (the x-axis) denotes the temporal position within the sequence. Each time the looping timeline of the sequencer hits a player's position, a sound is triggered. There are three sounds¹¹ that can be switched manually by the humans and that are also switched by the virtual players.

The players and sequencer timeline are also displayed on the screen, however, the visuals can be ignored for a purely auditive experience.¹²

4.4.1 Development

I have been continually developing *KlingKlangKlong* throughout the duration of this thesis. There were several iterations during which I rewrote the complete application. This is because of two separate reasons. The first one is technical. Initial work on *KlingKlangKlong* began in summer 2014 to construct a laboratory for ideas about playful systems. The first prototypes that I implemented rather hastily only worked on Android mobile devices, while the synchronisation of real-time updates turned out to be a technical challenge. In the first play tests, the application crashed frequently.

During the next iterations, I re-developed the application based on web technology. Benefits are a single programming language for client and server (JavaScript), the availability of libraries and frameworks and better support for real-time apps for both Android and iPhone. Updating the app does not require access to the mobile devices, but can be done while the application is running, which is an important aspect for rapid development and experimentation.

A potential disadvantage is that code running in the browser adds some overhead that

¹⁰In a pattern sequencer, each row (the y-axis) holds a different instrument.

¹¹The limitation to three sounds have inspired the name *KlingKlangKlong*, which is also a reminiscence to *Kling Klang/Klingklang*, the name of the recording studio and of a track on the second studio album of German electro pioneers Kraftwerk (1972).

¹²In this case the player would not be switching instruments.

negatively affects the performance of the system. Web technology has been evolving rapidly during the last years, and changes in policies are affecting the technical capabilities that require frequent updates to the application in order to keep it operational.

KlingKlangKlong comprises a server component that runs in the cloud and clients that run in a web browser. A human player loads a client into her web browser to start playing. The main function of the server is to receive and redistribute the positions of the players. The clients translate these positions into items on the screen and into sound. A special client is available to manage the running system, start and stop virtual players, and set the geographical area. The server also includes the implementation of artificial agents.

I am developing four different types of agents to be able to play and experiment with the system:

- Static: Static agents can be placed at specific positions and do not move.
- Random: These agents perform a random walk. All of their movement is stochastic.
- Flocking: These agents exhibit group behaviour that is reminiscent of a swarm or a flock of animals. It emerges from simple rules that were developed by Craig Reynolds (1987). These rules govern the separation, alignment, and cohesion of the swarm.
- Virtual (work in progress): Virtuals are agents that exhibit behaviour between randomness and purpose (compare Play vs. Purpose (p. 54)). They are currently being implemented with a modified variant of reinforcement learning¹³ (Sutton and Barto 2018). In the generic version of reinforcement learning, the environment provides rewards that the agents are supposed to maximise. My modification to this model aims to develop agents that do not try to maximise their reward, but keep a balance between going after the reward and exploring the environment. In section Game AI vs. Playing Machines (p. 106) I have described this approach to play in terms of the distinction between scientific and artistic machines.

I will discuss *KlingKlangKlong*'s exposition and its conceptual and performative aspects in the next two sections.

¹³The code that I am currently developing is a re-implementation and modification of Karpathy (2015). As the implementation of the "Virtuals" is work in progress and subject to future research, it is not included in the distribution provided in the Appendix.

4.4.2 Exposition



Figure 4.3: KlingKlangKlong at Playpublik Krakow

An early prototype of *KlingKlangKlong* was shown at Playpublik Festival Krakow in September 2014 and at the Plymouth Book Festival in October 2014. I showcased a further iteration at playin' Siegen in Siegen in April 2015. Another exposition took place at the Off The Lip conference in Plymouth in October 2016.

The mode of presentation and observation at each of these events was similar to the exposition of *neurotic*, described in section Exposition (p. 101). However, during the artistic exposition of *KlingKlangKlong* I shifted from the human player oriented design to my anthroponeutral approach (see Anthroponeutral Design (p. 157)). This had consequences for the technical design, which now automatically adapts to human players. It also had an impact on my development practice, which I have carried out without human player intervention, focusing on the anthroponeutral approach since 2017.

In 2016 I also co-authored the article *Playful Locative Ensembles in the Urban Soundscape* with Sebastian Quack (Straeubig and Quack 2016), comparing and contrasting *KlingKlangKlong* with two other urban sound ensembles: *A Folded Path* by circumstance (Speakman, Anderson, and Grenier 2013) and *Phantom Synchron — Soundtrack Weimar* by Daniel Ott, Sebastian Quack, Kirsten Reese and Enrico Stolzenburg (Ott et al. 2015).



Figure 4.4: KlingKlangKlong session at Playpublik

In the context of urban sound art, these three projects have a common theme: the idea of an ensemble moving through an urban environment while producing sound against the background of the city. Yet they implement this concept in different ways. *A Folded Path* consists of a human swarm where each player carries an instrument, contributing to a changing, moving, polyphonic soundscape. *Phantom Synchron — Soundtrack Weimar* creates a soundtrack in the streets, a choreographed space-time opera which requires precise synchronisation from the members of the ensemble. *KlingKlangKlong* is based on the notion of antropoponeutral play, gathering human and nonhuman players on an ephemeral playground in dialogue with procedurally generated sound.

4.4.3 Discussion

The progress I made designing and developing *KlingKlangKlong* marks important steps towards my creation of playful systems. I began building the first prototype a few weeks into my PhD project. My rationale was to explore early ideas through practical iteration and reflection. *KlingKlangKlong* was created as a laboratory and a playground that allows approximations to playful systems, while the characteristics of these systems can be

observed through distinctions. These would be guiding my design during a developing methodology through devising, constructing, exposing playful artefacts and reflection through sequences of distinctions. This poses the question of where to start.

Spencer Brown's dictum "Draw a distinction", discussed in section Spencer Brown: Draw a Distinction, makes it explicit that in order to start any process, a primary distinction has to be made. I will argue, similar to (Baraldi, Corsi, and Esposito 1997), that this initial choice both does and doesn't matter.

It does matter, because in an autopoietic system the primary distinction, its code, is guiding subsequent differentiations (Luhmann 2009, p. 194-209). The scientific system operates with the code true vs. false, this thesis has started with the code play vs. work (compare Play vs. Work (p. 51)), this chapter opened with human vs. machine. The original observation, when traced back, reveals a distinction that structures the space of possibilities by selecting one side of it. Subsequent distinctions take place in that sub-space and observing the same distinction again constitutes a re-entry — a concept that Luhmann has adopted from Spencer-Brown (Luhmann 1993; Spencer-Brown 2008). In a re-entry, the system observes its own code, that is the distinction on which it is based, through this distinction. This requires reflection, the self-observation of a system as a system against the background of its environment (compare A Third Culture? (p. 149)).

It also does not matter, because in practice it is possible to reset and start anew from a different distinction. During the iterations of practice, reading, discussing and writing for this thesis, my project has revealed itself gradually as a hyper-structure of interconnected texts, performances, talks and artifacts. This may sound similar to the concept of the rhizome described by Deleuze and Guattari (1987) in that any distinction, any of the chapters, can serve an entry point¹⁴. To transform such a structure into the form of academic writing, it is necessary to serialise it. However, distinctions can be observed in a different order, and the text can be read differently. The cross-referencing between sections is an attempt to do justice to this structure by mirroring the underlying distinction-based theory. Luhmann maintained over four decades an enormous hypertextual card index, the *Zettelkasten* containing around 90.000 handwritten notes, while serialising its contents into 600 publications, among them 40 monographs (Jahraus et al. 2012).

As psychic and social systems equipped with a memory, we cannot completely erase past

¹⁴For a fundamental critique of Deleuze and Guattari's concept of the rhizome in its distinction from a tree, see (Burger 1985).

observations. This would require amnesia. Therefore, in contrast to Spencer-Brown's theoretical starting point from a tabula rasa (Spencer-Brown 2008, p. 3), in practice one never begins from a completely empty space¹⁵ nor within an empty environment (as I argue in section Architecting Environments (p. 126)). Every decision reflects on previous impressions and experiences. In the case of *KlingKlangKlong* those include my previous experiences as a designer of location based games such as *Tidy City* (Straeubig 2008; Wetzel, Blum, and Oppermann 2012).

Thus the initial distinction I selected while constructing *KlingKlangKlong* is the one between system and environment (see System vs. Environment (p. 123)) to explore the interaction of a system (the players) with the environment (the city). This distinction creates practical constraints for the design, for example considerations about the safety of players moving in urban traffic. I assume that using audio as the primary medium for a locative experience is less distracting than forcing the players to focus on the screen. The system vs. environment distinction also leads to observations of mutual perceptions and expectations that are taking place when players and non-players share public spaces. Sebastian Quack and I further explore this topic in (Straeubig and Quack 2016).

With the initial distinction set in motion (see Spencer Brown: Draw a Distinction (p. 28)), I undertook deeper research into Luhmann's theories¹⁶ and subsequently based my methods on distinctions, paired with iterative prototyping (Houde and Hill 1997), a design method that encourages building artefacts from early stages of a project (see Towards Play Design as Research (p. 154)).

During the development of *KlingKlangKlong*, I investigated the distinction between social and other types of systems (see Luhmann: Distinctions Create Meaning (p. 33)). This led me into two parallel directions of research. One was geared towards biological systems and was largely inspired by previous work (Matthias 2013) (see Discussion (p. 102)). The other direction led me to observe social systems as systems of communication, without regard to the inner states of the participants. I began redesigning *KlingKlangKlong* in a way that abstracts from human player experience (see Exposition (p. 113)), and from this point focused solely on this perspective. In this selection, another distinction became visible, the one between humans and machines.

¹⁵Even to read and comprehend Spencer-Brown's injunction "Draw a distinction!", one needs to have drawn distinctions, a paradox that is discussed extensively in (Spencer-Brown 2008).

¹⁶I began reading Luhmann in the 1990s and was first exposed to (Luhmann 2000) in a theatre studies seminar organised by Claus Just at the University of Erlangen-Nuremberg.

Observed through the lens of the third person perspective (see Paradoxa of Play (p. 69)), *KlingKlangKlong* is a machine, a computational process running on a computer hardware. By introducing non-human players, it also includes entities that represent players. A growing field of research is concerned with making these artificial players more human-like both in appearance and in behaviour (compare Game AI vs. Playing Machines (p. 106)). My goal became a similar one: to reduce the differences between humans and machines (see Anthroponeutral Design (p. 157)). Paradoxically, I first had to introduce the human vs. machine distinction in order to subsequently try to make it invisible in *KlingKlangKlong*. In the next section I operate with the same pattern again, reversing the hiding of this distinction in order to discuss its overcoming.

4.5 Beyond Humanism

In sharp contrast to the humanist perspectives towards play of Hannah Arendt (1998) and Johan Huizinga (1955) are postmodern and post-human voices including Donna Haraway's Cyborg Manifesto (Haraway 1991) in which she deconstructs human essentialism from a feminist perspective.

Similar perspectives are shared by a heterogeneous set of theories. Bruno Latour's Actor-Network theory postulates assemblages of humans, animals, robots, agents, animats, hybrids, swarms (Latour 1998; Latour 1999a; Latour 2005) while Xenofeminism (Laboria Cuboniks 2018) takes an almost agnostic perspective towards human nature, similar to Michelle Westerlaken's non-speciesism (Westerlaken 2017).

Meanwhile metaphysical theories such as object-oriented ontology, a recent philosophical direction influenced by Heidegger, have put nonhuman objects into the discourse on games and play (Bogost 2006) (see the footnote in Luhmann: Distinctions Create Meaning (p. 33)).

My own project presented in this thesis with its foundations on cybernetics and systems theory (see Distinction vs. Identity (p. 15)) proposes a fundamentally different approach that relies on systems. The practice of anthroponeutral design, pursued in particular with my project *KlingKlangKlong* (see Project: KlingKlangKlong (p. 110)) constitutes a critique of distinctions between human and machines, and between virtual and actual participants of play. I will return to the issue in the final chapter to discuss possible directions to pursue

further (see *Anthroponeutral Design* (p. 157)). First, however, I will extend the speculative research question “can machines play” into the ontological realm in the next section.

4.6 Counterpoint: Machines Play

In this section, I take up a speculative direction by discussing premises under which the question “can machines play?” necessarily becomes true, purely by logical considerations.¹⁷ I suggest that there are at least eight different sets of assumptions that would validate this consequence, each of them having a different speculative nature. My goal with this approach is to observe and question ontological assumptions that usually go unchecked into statements about play.

1. The mind is a machine. The first of these positions is related to computationalism, the idea that the mind is a machine. It has some proponents among computer scientists and philosophers of mind. For example, Fodor (1975) suggests that mental states are computational states and that the human mind is a machine. If this is the case, then machines play because humans play.
2. Animals are machines. Descartes (1972) claimed in “De homine” that the lower animals — unlike humans — are in principle automata. This in particular entails that unlike humans, animals have no eternal soul and that their behaviour can be completely reduced to physical explanations. Following Descartes’ argumentation, if animals play as ethologists have established (see *What Is Play?* (p. 15)), and animals are machines, then machines would play. From this we could conclude that qualities which are unlikely to be reduced to physical descriptions, like consciousness, ethics and aesthetics, are strictly not required for play.
3. Humans become machines. A scenario explored in transhumanism (see *Beyond Humanism*) is that humans and machines will be converging into cyborgs, entities where the distinction between the biological and the technical becomes increasingly blurred (Haraway 1991). As a thought experiment, we might start with a 100% biological human and gradually replace organ after organ with technological implants. If at some point a sufficient amount of biological material is replaced, we might observe a machine that is still playing.¹⁸ The medical boundaries of what can

¹⁷I began this line of inquiry in (Straeubig 2015a) and (Straeubig 2015b).

¹⁸This assumes that we carefully avoid to replace a part that is biologically responsible for play.

be replaced or augmented are moving rapidly, radically questioning the distinction between nature and technology towards a form of convergence (Fuller 2011).

4. Everything becomes play. Gamification, the principle of adding elements from games to non-game contexts, is deployed to shape behaviour (see *Play vs. Work* (p. 51)). Applying the distinction between virtual and real, Game designer Jane McGonigal (2012) has strongly argued in favour of techniques that make everyday chores more playful. Game scholars such as Ian Bogost (2011) have launched harsh critique, likening gamification to a marketing gimmick solely deployed to incentivise purchasing. Nevertheless, governments and commercial actors are widely deploying these concepts, with the Chinese social scoring system just one widely discussed example (Ramadan 2018). If we extrapolate this trend to its logical conclusion, then we can image a society where all activities are gamified. Then the distinction between play and work would break down and with it the notion that machines work but do not play. Without a distinction play vs. non-play however, we would also find ourselves in a situation where the notion of play has lost its meaning (see “Everything is play” below).
5. The universe is computation. This metaphysical position seems related to the first point, except that it does not specifically refer to the mind. A representative of this direction is Wolfram (2002), postulating that the whole universe is a computational machine.¹⁹ If we could observe entities that play in this scenario, it would entail that machines play.
6. AGI is going to happen. AGI (artificial general intelligence) is the speculation that artificial intelligence will surpass human intelligence in all respects, the moment of overtaking being dubbed as “singularity” (Kurzweil 2009). Scientists stress the benefits of play for learning (see *Play vs. Learning* (p. 56)) and for creativity (see *Play vs. Learning* (p. 56)), thus a potential superintelligence would have adopted playful behaviour, except if it concludes that play is not useful (compare *Play vs. Purpose* (p. 54)). In (Straeubig 2020a, (to appear)) I speculate how a continuously learning AI (compare *Game AI vs. Playing Machines* (p. 106)) could approach a “singularity”, by playing and communicating in virtual worlds while crossing boundaries into other social systems and finally into physical space with the help of humans. The

¹⁹Floridi (2009) advises caution, by emphasizing the distinction between digital and informational ontology.

science fiction author Daniel Suarez has explored a similar scenario with a dystopic underpinning in his novels (Suarez 2011; Suarez 2010).

7. Machines always play. The characteristics of Csikszentmihalyi's concept of flow discussed in section Presence vs. Immersion (p. 127) have pointed me to the idea that playful states should be in some sense simpler than non-playful states. Intuitively, animals would be in flow states, undistracted, living in the here and now. Why not machines, then? Panksepp's research on play in deeper brain structures adds some credibility to this speculation (see Discussion (p. 102)). Speculating about the phenomenology of other psychic systems, I want to echo Nagel's question (see Exploring the Virtual (p. 91)): What is it like to be an artificial entity? Would a machine be able to distinguish between work and play? And if so, would it see itself working or playing? I think it is sound to assume that the machine would have both intrinsic and extrinsic motivations. Therefore, when we observe machines as purely working, for example assembling parts in a factory, we could be wrong. From *their* first-person perspective, machines might not work, but play.

8. Everything is play. Based on his definition of a game (see What Is Play? (p. 15)), Suits (1967) muses over the question if life could be a game altogether, although one that is played unconsciously. Suits suggests that we might play two unconscious games: one is the rule which forbids resorting to end one's own life.²⁰ and the other the zero-sum game of the maximisation of one's own pleasure. Both of Suits' hypothetical games would also apply to machines. In Hinduism there is the pantheistic, non-dualistic concept of Lila, the playful universe. Lila is a way of describing all reality, including the cosmos, as the outcome of creative play. Play is everywhere, strange loops (compare What Is Play? (p. 15)) disappear and all distinctions finally vanish. Game over.

4.7 Summary: Deux Ex Machina

Whereas the previous chapter asked epistemological questions about play by looking at different forms of experiences with reality and non-reality, this one has started with asking questions about non-human players.

²⁰Compare with Kolnai's dilemma of winning vs. ceasing to play (see Play vs. Games (p. 65)).

Extending the notion of a player from human to non-human and finally into the realm of machines, has brought back questions about the reality of play, both from a post-human evolutionary perspective (see *Game AI vs. Playing Machines* (p. 106)) and from a speculative, ontological one (see *Counterpoint: Machines Play* (p. 118)). In this light, we have to critically review Schiller's exclamation quoted at the beginning of this chapter that praises play as the highest expression of human qualities.

However, I would contend that Schiller's "Spieltrieb" (Schiller 1795) has much more in common with Panksepp's "primary processes" (Panksepp and Biven 2012) in the sense that they both postulate play as essential: Schiller from an idealistic standpoint and Panksepp from a biological-evolutionary point of view. As a structurally more simple biological function, Panksepp's primary process would also be easier to implement than the holy grail of artificial intelligence, human level intelligence or even consciousness. Some research into AI, which has already relocated boundaries between humans and machines (see *Game AI vs. Playing Machines* (p. 106)) tries to make sense of playing machines as biological systems. By pointing to the "cognitive nonconscious", Katherine Hayles (2017) is looking at cognitive levels below consciousness, avoiding the "hard problem" (see *Can Machines Play?* (p. 97)).

Based on distinctions between the different types of systems (see Luhmann: *Distinctions Create Meaning* (p. 33)), I have taken a different route and proposed to extend Luhmann's concept of social systems by inviting machines into them. Instead of focussing on consciousness, I was observing communication. There I found play — within the social system, not in the biological or psychic ones. I have delineated how my own practical experiments to understand play have led me to experiment on both levels: with a biological model for spiking neurons and with the concept of an interactive, playful system, manifest in my projects *neurotic* (see *Project: Neurotic* (p. 100)) and *KlingKlangKlong* (see *Project: KlingKlangKlong* (p. 110)).

In section *Counterpoint: Machines Play* (p. 118), I have visited several premises that make the proposition "machines play" necessarily true. This marks a counterpoint to the rest of this thesis, where I am trying to make my point by argumentation, description, persuasion and rhetorics. Here, simple logical reasoning suffices.²¹ Yet the conclusion is highly speculative: If any of the premises would be true, machines would play!

²¹All logical forms in that section are in the gestalt of Modus Ponens: If we accept the premise as true and if we can deduce the conclusion from the premise, then we accept the conclusion as true as well.

We can rephrase the question raised in section Can Machines Play? (p. 97) from “can machines play?” to “would machines play?”. Then we can start asking the machines. Their possible answer might be found outside of play itself. This is where I will focus my attention on in the next chapter: on the environments of play.

Chapter 5

System vs. Environment

And all I want to do today

Is hang around with you and play

Like we were little kids again

And this big world is just a little playground

The world is our playground

Mikey McCleary (2014)

5.1 What Surrounds Play?

During the previous three chapters, I have observed play through various distinctions as a phenomenon itself (see Play vs. Non-Play (p. 49)), in its relations to reality (see Virtual vs. Real (p. 73)) and in terms of the playing subject (see Human vs. Machine (p. 97)). In doing so, it was important to adopt a notion of systems that operate within environments. This has enabled me to cross numerous distinctions into “the other side”, observing other systems in the environment of play. Instead of dissecting play into the constellation of elements as definitory methods attempt to do (compare What Is Play? (p. 15)), I have followed Luhmann’s and Bertalanffy’s approach to draw attention away from systems as complex entities towards the distinction between a system and its environment (see Luhmann: Distinctions Create Meaning (p. 33)).

This way of dealing with systems mirrors Ashby’s sentiment about the brain: “There can’t be a proper theory of the brain until there is a proper theory of the environment as well [...] the subject has been hampered by our not paying sufficiently serious attention to the

environmental half of the process. [...] the ‘psychology’ of the environment will have to be given almost as much thought as the psychology of the nerve network itself” (Pickering 2011, p. 105).

In the following sections I will apply this ecological thinking to play by asking about the environments of play¹ As the environment is “everything else” apart from the system, a system itself cannot observe it, it can only observe other systems in its environment (Luhmann 1996, p. 176-209). This leaves the observation of an environment to an observer who has made a distinction between a system and a specific environment. Second order observers are capable of observing a multitude of environments, say legal, economic or political environments of play. A distinction, for example, the one between play and work (see Play vs. Work (p. 51)) or between play and reality (see Is Play Real? (p. 73)) guides these observations.

Systems and environments also interact in terms of co-evolution (Bateson 2000a), which raises questions about fitness, variety and survival, not only from the perspective of the system but also for systems in its environment.

Interferences between systems of play and non-play can lead to unforeseen and serious consequences. When the English government steeply raised taxes on playing cards in 1710, the measure laid ground to a wave of forgeries and it led to protests that are considered as one of the causes for the American pursuit for independence (Tosney 2008). Ultimately, the tax was removed in 1960.

With the exception of a speculative angle like “everything is play” (see Counterpoint: Machines Play (p. 118)), in order to play a player has to cross the boundary between play and non-play twice, entering and leaving the “magic circle” (see Magic vs. Pervasive (p. 128)). This invites debate about the nature of these boundaries, about the ways to cross them, and in the context of designing playful systems, about approaches to design these borders (see Experiential Architecture (p. 160)).

Focussing on the distinction between system and environment produces many new questions². In this chapter I will approach the question of whether play can be understood in terms of the environment rather than of the playing system itself? The notion of the

¹ Ecology is the study of interactions between systems and environments, a term coined by Ernst Haeckel (1866) in 1866 in the context of biological systems.

² I want to mention again von Foerster’s ethical imperative that warrants creating new questions instead of answering them (see Von Foerster: Second Order Cybernetics (p. 29)).

playground, discussed in the next section, will be a useful starting point.

5.2 Playgrounds vs. Non-playgrounds

Questions about the environments of play raised in the previous section have to be answered differently for different system references. Physical environments for play can be playgrounds, sports stadia, billiard rooms, preschools, gambling halls and other places, *Spielwiesen* (literally: play meadows) that signal that play is welcome to take place (Sicart 2014, p. 49-59). While playfulness does not require permission, those places invite and encourage, but also limit the kinds of play that are expected and appropriate.

Thus the chess tables in New York City's Central Park were not intended for the playfulness of skateboarders. *America's Army*, a video game commissioned by the United States Army for recruitment purposes (Ubisoft 2002) did not anticipate a "gonzo gamer" who would be texting soldiers' names killed in the Iraq war to other players (Schrank 2014, p. 127-133). Nor did inner cities ask for guerrilla gardeners to come and plant plants there (see Project: Speed Gardening Guerrilla (p. 138)). Limits, rules and expectations do not prevent players to appropriate, repurpose and subvert spaces for play (Sicart 2014, p. 71-81), (Salen and Zimmerman 2003, p. 556-569).

This raises the question whether there are any "non-playgrounds" in a strict sense, places where play behaviour should be absolute off-limits or is outright illegal? A few suggestions come to mind like the operating theatre, a court hearing or the cockpit of an airplane. Yet jokes, wordplay, acting and other playful behaviour is common in these places, despite the serious issues involved. Other environments carry implicit protocols, such as the audience hall in a contemporary theatre where it is expected for the visitors to sit in silence or applaud while all play takes place on stage³. However, these are cultural agreements that can be handled differently, say during plays for children, and have been handled differently historically, e.g. in Shakespearean theatre. Breaking the "fourth wall" (Diderot 1994), the invisible line that demarcates the magic circle (see Real vs. Imaginary (p. 80)) frequently happens in theatre, but in contrast to the acts of playful appropriation depicted above it has to be initiated by the performers.

³The house rules governing audience behaviour construct a virtual (see Actual vs. Potential (p. 83)) legal environment that is set by the institution in which play is organised (compare Luhmann: Distinctions Create Meaning (p. 33)).

In 2008 during a visit at the Museum of Modern Art in New York City I witnessed a fascinating exhibit of play as a risk to damage. A child in a corner was furiously scribbling on a piece of paper with her crayons while a visibly nervous security guard kept a suspicious eye on the scene, ready to intervene. The palpable tension was due to the fact that less than a meter from the girl a very expensive artwork was on display. Finally, the father took the child away to a safer space.

A categorical claim by scientists about play is that “the behaviour occurs in a protected context where the player neither ill nor stressed” (Bateson and Martin 2013). By providing social environments to rats, Bruce Alexander apparently has observed positive effects regarding addiction (Gage and Sumnall 2019). Burghardt calls these requirements a “relaxed field” and insists that it is a necessary criterion for play (Burghardt 2010, p. 16). The most harrowing evidence against this view can be found in George Eisen’s grim account how play took place even in the face of annihilation and sometimes literally meters away from death in the ghettos and concentration camps of the Holocaust (Eisen 1990).

5.3 Architecting Environments

The notion of physical and digital playgrounds has not only implications for observing playful systems (see The Meaning of “Meaning” (p. 87)), but also for their design. Video games such as *Minecraft* (Mojang 2011) are created as digital playgrounds where players literally construct a world that offers the material for its own creation. More subtly, games like *Proteus* (Key and Kanaga 2013) relocate this world construction into the head of the players — a playground for the mind⁴ (Sicart 2014, p. 49-59).

Ludic architecture requires designers to give up control over the system and encourages them to deliberately shift their attention to the environment (Walz 2010). The concept of affordances (Gibson 1977) can be used to design and place items in the environment that signal ecological cues which encourage or discourage play (see also Game AI vs. Playing Machines (p. 106) and Discussion (p. 42)). Miguel Sicart sums this idea up succinctly: “The designer of games should not act as a provider of anything other than context” (Sicart 2014, p. 90).

I believe it is equally important to notice that architectural work begins from an existing

⁴The term “walking simulators” that has been attached to these games (Carbo-Mascarell 2016) is based on a distinction that fails to observe this aspect.

environment, not from a blank slate. Often it is necessary to clear the ground and to remove obstacles first. In section Discussion (p. 42) I have discussed the impact of a hostile, defensive architecture in the context of urban planning and design. Ellin and Blakely (1997) proposes that in order to overcome those environments, one must rethink privatisation, gated communities, protected spaces and replace “architectures of fear” with methods of empowerment and place making. These practices are available to create playful and inclusive physical and virtual spaces.

As initial points of departure, established guidelines for designing playful spaces can be utilised (Shackell et al. 2008). They may result in playgrounds that allow risk, experimentation and co-construction: a perspective that is beautifully illustrated in (Burkhalter et al. 2016) which depicts playgrounds created between 1960 and the 1980s as creative laboratories that invite players to be present, creative and alive.

5.4 Presence vs. Immersion

Residence in virtual realities is often related to the concept of immersion, the perception of being physically present in a nonphysical world. To untangle the relationship of presence and immersion, we can start from the distinction between first person and third person perspective (see Requirements for a New Paradigm (p. 24)). Immersion is inherently a first-person phenomenon that renders the distinction between the virtual and the real invisible. An external observer might register indications for immersion by measuring signals from a biological system but cannot communicate with an immersed system without recourse to its memory. Presence as being in the present moment therefore is incommunicable. This relates to the concept of flow, brought forward by the psychologist Mihaly Csikszentmihalyi (1991) also relates to immersion. Flow is characterised by the following six attributes (Csikszentmihalyi and Nakamura 2009):

1. concentration on the present moment
2. merging of action and awareness
3. loss of reflective self-consciousness
4. a sense of personal control over the situation
5. a distortion of temporal experience

6. experience of the activity as intrinsically rewarding

This is a description from a third person scientific perspective. Communicating the first person experience of a flow moment requires metaphorical language. Similarly, Janet Murray (1998, p. 99) describes immersion as a jump into the swimming pool: “the sensation of being surrounded by a completely other reality, as different as water is from air, that takes over all our attention, our whole perceptual apparatus”. Mel Slater (2003) suggests that the term “immersive” should be reserved for properties of the technology and the environment, while “presence” should be used for the corresponding properties of a user’s subjective experience.

In digital games, physical presence is mediated through an avatar (Klevjer 2012). This presence has to be carefully constructed by matching the perceptions and action of the player with the visual and auditory presentation of the game (Swink 2009). Only then has the player a chance to suspend disbelief and become immersed in it.

Richard Bartle (2004) proposes to distinguish between levels of immersion based on ways the player is represented within the game world: The *Spielfigur* is a means to influence the game world. An avatar represents the player in the game world and players refer to their avatar in 3rd person language. Players identify in first person perspective with a character. With a persona, the identity of the player and the *Spielfigur* merge. The player inhabits the virtual world. I would critique Bartle’s interpretation of these concepts as grades of immersion and ask if they can just denote different experiential qualities instead. Daniel Vella (2016) takes the construction of identity further by analysing how the ludic self constitutes itself. Vella (2015) also observes that it is through virtual embodied action that a player becomes a subject in the game world.

5.5 Magic vs. Pervasive

In the previous section I gave an account of the system vs. environment distinction from the perspective of the system, immersed within the boundaries of a magic circle. Now I move on to observe playful phenomena that permeate this boundary: pervasive games.

According to Markus Montola (2005, p. 3), pervasive games have “[...] one or more salient features that expand the contractual magic circle of play socially, spatially or temporally”. Pervasive games have been researched extensively (Montola 2012a; Montola 2009;

Nieuwdorp 2007; Magerkurth 2007), and several subgenres have evolved since the early 2000s.

Locative games and artistic interventions take up the spatial dimension; they appropriate, repurpose and sometimes irritate public spaces. Citing artistic practices like mapping, geo-annotation and dislocation, Drew Hemment (2006) distinguishes locative arts and the concept of mixed reality (compare Virtual vs. Physical (p. 79)): “Whereas ‘mixed reality’ posits the virtual and physical as layered or intersecting, these projects suggest that something else can be produced in between”. My projects *neurotic* (see Project: Neurotic (p. 100)) and *KlingKlangKlong* (see Project: KlingKlangKlong (p. 110)) can be identified as locative experiences. In addition, *Speed Gardening Guerrilla* pervades the invisible and complex legal boundaries of guerrilla gardening (Reynolds 2009) (see Project: Speed Gardening Guerrilla (p. 138)).

Live action role-playing games (LARP) constitute a second form of pervasive games that create temporary immersive zones for players to experiment with fictional roles and identities. The particular strong tradition of organising these events in Nordic countries has established “Nordic LARP” as a genre designation (Stenros and Montola 2010). LARP share characteristics with Alternate Reality Games by asserting a fictional reality to the players while keeping the game veiled from surrounding non-players (compare Real vs. Imaginary (p. 80)). Both ARG and LARP are run by groups of “game masters” who steer the game while it is running, negotiating with and sometimes conceding control to the players (Jonsson et al. 2007).

Eva Nieuwdorp (2005) has described the magic circle constructed by pervasive games in terms of a “liminal” interface, where players cross both distinctions between playful and serious — the paratelic interface — and play vs. games (see Play vs. Games (p. 65)), the paraludic interface. The deep social and emotional impact of Live Action Role Playing regularly persists beyond the boundaries of the events themselves, a phenomenon that Annika Waern (2011) has called “bleed” between game and non-game contexts.

Bleed is one of the ethical issues that arise in the relation between pervasive games and their environments. (Montola et al. 2006) have identified several other ones, in particular involuntary participation of non-players, possible (ab-)use of power by organisers over their participants, privacy concerns and issues staging games in public space. The latter also relates to my discussion of *Speed Gardening Guerrilla* (see Discussion (p. 141)).

Bleed also takes place in the “futuristically political” work of Omsk Social Club (2019b), a collective of artists that is hacking Live Action Role Play, immersive action, modern day culture and post-political futurism to reveal deeper social structures.⁵ Their experimentation with phenomena such as rave culture, survivalism, catfishing, desire and sacrifice, positive trolling, algorithmic strategies and decentralised cryptocurrency blurs realities into a superposition of interfering magic circles.

5.6 Project: Non-Sense of Place

Non-Sense of Place is the name of an exhibition that consists of three of my projects: *Speed Gardening Guerrilla*, *Pedestrian Fitness Initiative for Plymouth* and *CO2rnwall CO2 Challenge*. These three projects address the distinction between system and environment.

I prepared *Non-Sense of Place* as a playful response to the theme of the Balance/Unbalance conference held at the University of Plymouth in 2017. That event was called “A Sense of Place”. I exhibited the three pieces simultaneously at a booth, parallel to the conference tracks.

5.7 Project: CO2rnwall CO2 Challenge

The *CO2rnwall CO2 Challenge* is an ironic take on environmental issues, climate change discussions and post-truth politics. It was created during the Fascinate conference, a week-long event organised at Falmouth University in Cornwall. It consists of performative, ritualistic elements to reduce the level of CO₂: breath constrictions, the covering of soil with a napkin and the reduction of ocean volume by scooping water from the sea. The project is documented in form of a website that includes a number of short video clips.

5.7.1 Development

The major part of my work for the *CO2rnwall CO2 Challenge* took place during the Fascinate conference in August 2014. At first I researched carbon dioxide emissions and wrote a short concept and the video clip scripts (see Appendix Dialogue), then I filmed on location with participants of the GeoHack workshop led by Duncan Speakman. While still

⁵I took part in an near-future themed weekend event called Athame, where we explored and played with topics around technologically mediated intimacy (Omsk Social Club 2019a).

at Fascinate, I assembled text and film clips into a website and presented the result in the workshop debriefing. After the conference, I kept editing the text.

5.7.2 Exposition

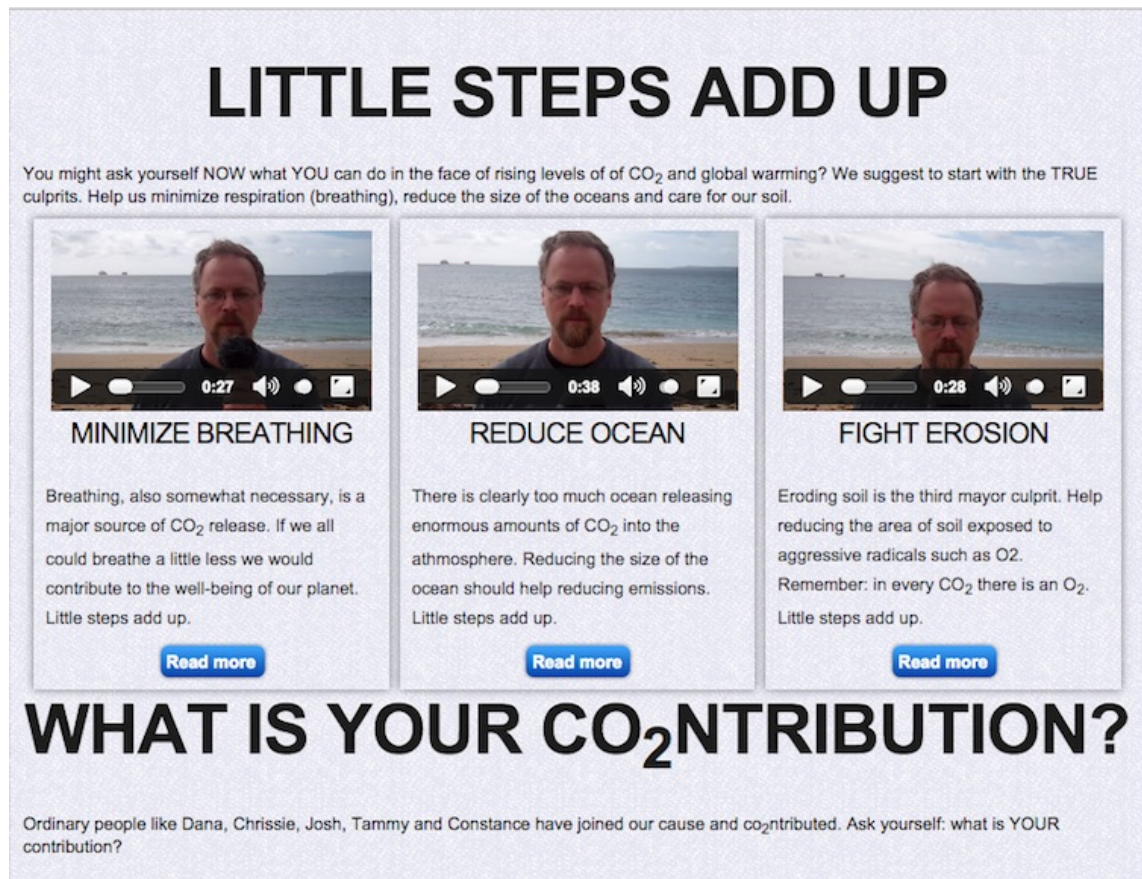


Figure 5.1: CO₂rwall CO₂ Challenge exercise suggestions

I presented the *CO₂rwall CO₂ Challenge* at the GeoHack workshop summary of the Fascinate Conference at Falmouth University in August 2014 and a second time three years later as part of my *Non-Sense of Place* exhibition during the Balance/Unbalance conference at the University of Plymouth.

5.7.3 Discussion

My initial impulse for developing the *CO₂rwall CO₂ Challenge* came from a critical response to the notion of artistic provocation. At the onset of the Falmouth workshop we were exposed to a "provocation" that consisted of a prerecorded talk by author and activist James Marriot, who has extensively traced the global oil economy in (Marriott and Minio-Paluello 2013). In the video, Marriot deplored the state of environmental issues

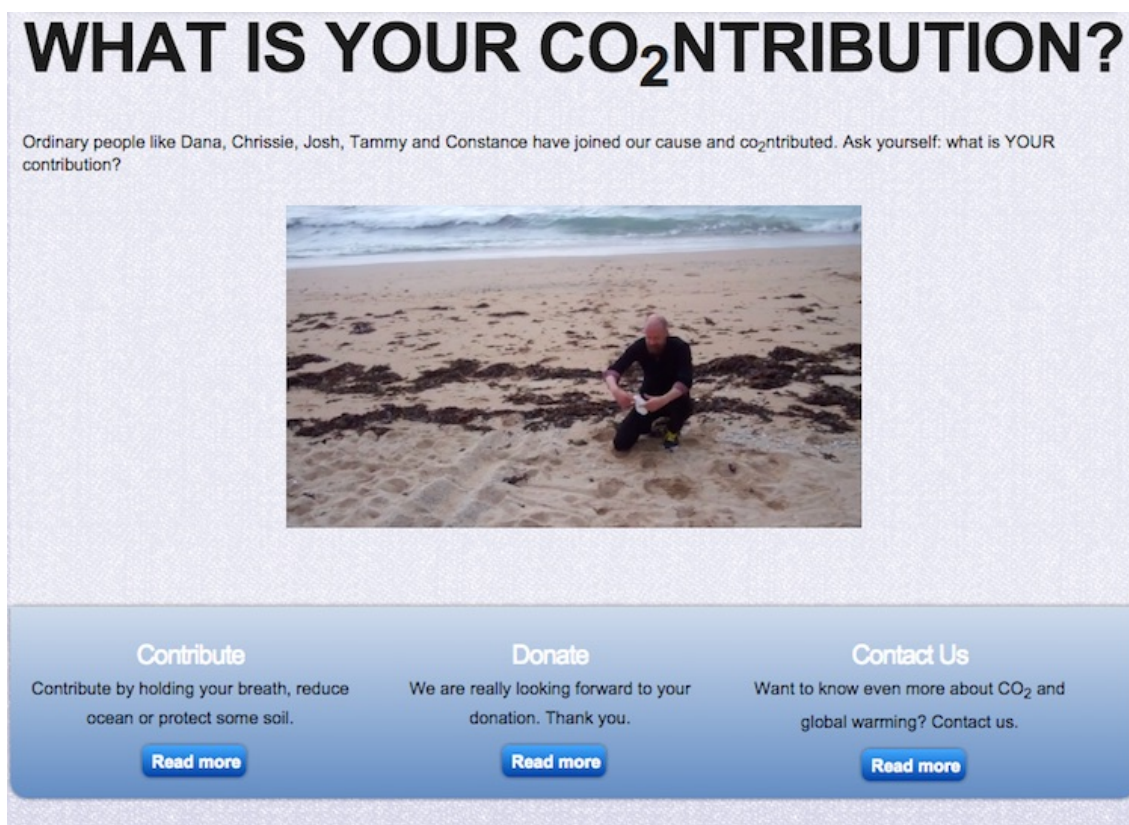


Figure 5.2: CO2rnwall CO2 Challenge performer covering soil to fight erosion

caused by that industry. In particular, he mentioned the practice of parking tankers near the Cornwall coast in order to wait for price surges in the market, upon which they would then deliver the charge. At the end of the talk we were encouraged to “do something about it”.

The Oxford English Dictionary defines “provocation”, among other meanings, as an “[...] action of calling, inviting, or summoning”, an “action of inciting; incitement, impulse, instigation; an incentive, a stimulus” (Murray 1970). I failed to feel provoked in the literal sense by this intervention. Rather, the charging of art with purpose, even “for a good cause” made me feel uneasy. Despite good intentions, art that is functionalised as a tool for activism raises similar aesthetic and conceptual questions than the ones discussed in *Play vs. Purpose* (p. 54).

Moral aspects aside, I could relate to the aesthetic side of the initiative. The next day I could spot one of the ships waiting for a price hike, anchoring near the coast where our workshop was held. Thanks to the induction the day before, the ship had acquired a new symbolic meaning for me. Now, the unmoving tanker represented the multifarious wrongdoings of the oil industry, but nevertheless radiated the aesthetic of the Anthropocene (Davis and Turpin 2015).

Drawing a distinction between hearing (hören) and listening (zuhören), German sound artist Felix Kubin (2019) asserts that when one encounters noise, the perceiver has a choice to actively re-interpret the experience away from noise with its negative impact towards a potentially interesting sound structure. A sculptural analogue to this aesthetics of noise⁶ can be seen in the installation *Plastic Reef* by Federico Uribe (see Discussion (p. 141)). This was the sense in which I began to appreciate the beauty of the oil tanker becoming part of the landscape. The ship is therefore visible in the frame of the video clips that I shot for the project.

I decided to pick up on the theme of the workshop, called “GeoHack” that was framing our contribution and try to “hack” the expectations of the organisers. Again, I choose to deploy affirmation as an artistic tool instead of distancing and plain criticism. Artists that work with this method are the Yes Men, who are often taking over the roles of their targets (Bichlbaum and Bonanno 2009) and Front deutscher Äpfel, who are subverting neo-Nazi symbolism in an exaggerated manner (Upravitelev 2014).

While this kind of ironical appropriation is at risk of being mistaken for the institutions it criticises, it also becomes increasingly problematic against the backdrop of fading distinctions between fiction and reality (compare The Meaning of “Meaning” (p. 87)) in the context of a so-called “post truth”-society, in which public discourse is dominated by corporate and political interests, lobbyism, conspiracy theories and professional influencing tactics. Steve Fuller (2018), whose philosophical background includes Plato, Popper and social constructionism but lacks any mention of constructivist epistemology, offers an eloquent critique of the post-modern condition, but somewhat curiously clings to a pre-modern absolutistic truth concept as a backdrop.

In section Constructivisms vs. Constructionisms, (p. 30) I argue for the radical constructivist approach to an ontology that considers the constructed nature of reality without denying a reality per se. According to these philosophies, the negotiation of truth is inherently individual and social because it results from communication. It requires argumentation, persuasion, discussion, and as such it is prone to power and authority. Those dependencies have been analysed by Friedrich Nietzsche (2008) and by Michel Foucault (1980). A question to consider within a theory of social systems is the following: if the distinction between true and false can be undermined by the political system, in the form

⁶Andrew Prior (2015) investigates the aesthetics and mediality of noise through post-digital glitch practices, modes of deliberate artistic disturbances introduced into analog media.

of political messages devoid of any meaning, in which position does that put those social systems that traditionally have dealt with the construction (science) and deconstruction (art) of reality?

With the absurdity of some the public debates on climate change it would be easy to mistake the presenter in the *CO2rwall CO2 Challenge* (me) for a climate denier arguing in seriousness, instead of an artist delivering an ironic comment. Therefore my artistic interpretation of the scientific findings and the design of the “climate-saving” exercises are deliberately exaggerated and unreasonable.

However, in analogy to *Spiel 1* (see Project: *Spiel 1* (p. 57)), I developed the narrative rooted in scientific facts and methods, which then takes its themes in a different, pretended direction. I based the assertions about carbon dioxide emissions made in the *CO2rwall CO2 Challenge* on scientific research (Alley et al. 2007; Bernstein et al. 2007; U.S. DOE 2008). The ongoing public discussion on carbon dioxide emissions, the greenhouse effect and climate change in general is pointing to a misalignment between the societal systems of science and politics, for example, when scientists are prevented from publishing their findings on grounds of political and economic interests (Kitcher 2010).

On the other hand, some researchers seek new sources of funding by taking advantage of gamification. I derived the title “CO2 Challenge” from the “Ice Bucket Challenge”, a 2014 marketing stunt that successfully gamified social pressure for a fundraising campaign rally (Sherman and Wedge 2017) (compare *Play vs. Purpose* (p. 54)).

While the *CO2rwall CO2 Challenge* primarily addresses the system/environment distinction in a proverbial sense, a web of other meanings have come into play that make it a piece of work for me that sits on quite complex grounds. The initial question that led me into the project, was about the moral responsibility of artists to “do something”, as we were told in the “artistic provocation”. As I am questioning the functionalisation of both play (see *Play vs. Purpose* (p. 54)) and art (see *Games vs. Art* (p. 63)), I am asking myself whether concrete and direct actions, for example against the ties of art institutions with oil, weapons, and surveillance industries through sponsorship and personal connections (Evans 2015) could be more effective? Do art and play even have to be measured in terms of effectiveness? Maybe they do, but only if the impetus is to “do something”: a strange

loop of expectation and fulfilment.

5.8 Project: Pedestrian Fitness Initiative for Plymouth

Pedestrian Fitness Initiative for Plymouth (PFIP) (Straeubig 2015d) is a site-specific intervention that juxtaposes satirically the theme of fitness and self-improvement with a critique of the traffic policy in Plymouth, England. In substantial parts of the inner city, cars are given high priority over pedestrian and bicycle traffic. Often pedestrians have to take large detours or wait twice just to cross the street, while car lanes are built like fenced racing tracks.

In *PFIP*, participants are encouraged to find locations in the city, where pedestrians have been restricted from taking the direct route between two points and are forced to walk detours to in favour of car traffic. The distance of the detour is to be measured, and the additional required effort is re-interpreted as a deliberate action to increase the pedestrian's fitness.

5.8.1 Development

Initially, the project began as a collection of impressions around inner-city traffic, when I started taking photos of intersections that caught my interest, as pedestrians had to take absurd detours, while at the same time car traffic was given free voyage. With the announcement and call to participation for the Mediacity 5 conference at the University of Plymouth, I developed the material into a project.

I researched into the concept of walkability (see Discussion (p. 137)), developed the concept for *Pedestrian Fitness Initiative for Plymouth* and designed and prepared the material in form of handouts, a website and props for the exposition. During that preparation, filmmaker Johanna Ickert contributed additional material.

5.8.2 Exposition

I presented *Pedestrian Fitness Initiative for Plymouth* initially at the Mediacity 5 conference, that featured the theme of "social smart cities", in May 2015.

In line with the distinction between system and environment, I also included it in the

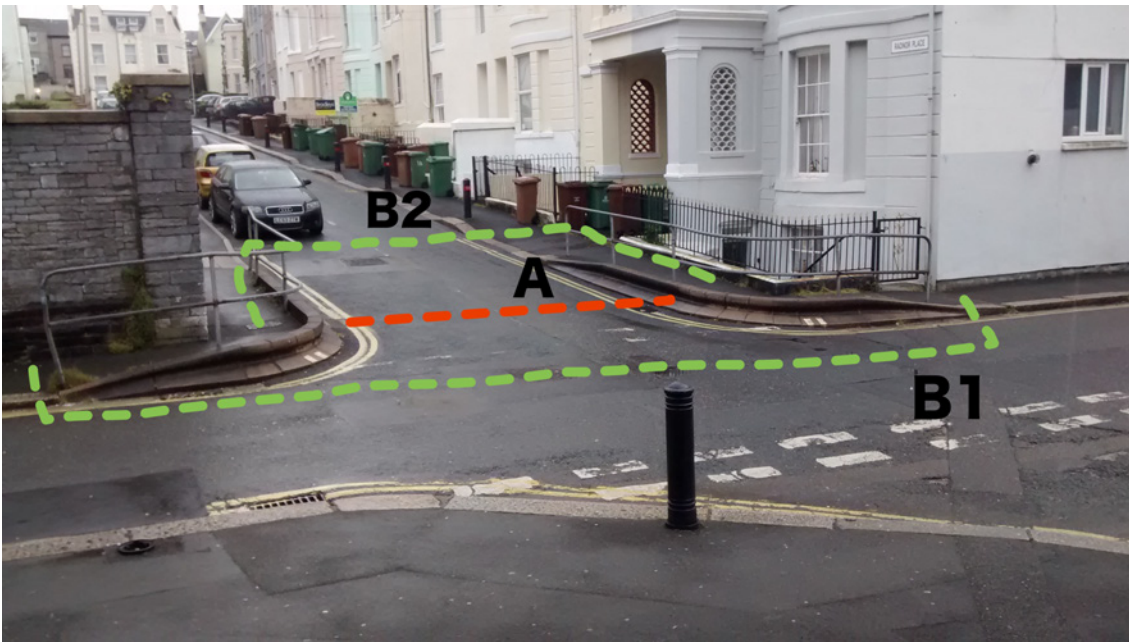


Figure 5.3: Pedestrian Fitness Initiative for Plymouth



Figure 5.4: PFIP presentation at Mediacity 5, University of Plymouth

Non-Sense of Place exhibition during the Balance/Unbalance conference in August 2017. Both events took part at the University of Plymouth.

5.8.3 Discussion

A few months before I applied for the position of a Marie Curie Fellow in the CogNovo Doctoral Training Program, I followed an invitation by Emma Wittaker to give a talk at the University of Plymouth. In that presentation I discussed different topological models for location based urban games, mappings between the virtual space of the game and the physical space of the city where it takes place (Straeubig 2013b).

Pokémon Go (Niantic 2016) for example uses trigger points, locations on the map where players encounter Pokémons, find resources and train their protégés.⁷ I argued that since the game layer that is cast over the physical world was virtual, there could be more diverse topologies, for example, the world would stretch in one direction like a chewing gum while in the perpendicular direction it would shrink.⁸ Thus it would be possible to reach some places easily while struggling to arrive at others, based on where you are heading.

After I had spent a few days as a pedestrian in Plymouth, I felt the city was built on that principle. You could walk longer distances as long as you did not need to cross the car traffic, which ran in barricaded lanes built like racing circuits. To reach your goal, you would constantly have to look out for tunnels, bridges, and heavily fenced crosswalks. Pedestrian traffic light periods are miserably short and most of the time you have to press the button and wait again in the middle between two tracks. I noticed that some routes were absurdly far compared to the actual linear distance. This was the birth of *Pedestrian Fitness Initiative for Plymouth (PFIP)*.

Among the current challenges for our growing cities are the reduction of carbon-based emissions (compare Project: CO2rnwall CO2 Challenge (p. 130)) and the management of traffic. In this context, the term walkability, i.e. the degree of accommodation of a city towards pedestrian movement, has been recognised as an important environmental, economic, and social factor (Leinberger and Lynch 2014; Leyden 2003; Rogers, Gardner, and Carlson 2013).

⁷In fact, it uses a trigger area, in order to deal with to inaccuracies in the measurement of the players' position.

⁸The mathematical branch of topology conceptualises these kinds of "chewing gum" geometries (Mendelson 2009).

Some cities have prioritised pedestrians, cyclists and public transport over car traffic. Several artistically influenced projects have reflected this challenge to city planning and management while utilising clever means of information visualisation to illustrate the problems (Colville-Andersen 2014; Elledge 2014).

PFIP came alive twice as a pop-up booth during artistic conferences at the University of Plymouth. I was showing examples of pedestrian-hostile locations in Plymouth, re-imagined as “fitness challenges” for citizens. During the events, I engaged in discussions with the visitors and encouraged them to look out for similar locations for themselves. There was a handout for participants and measure tape was available to determine the length of the forced detours. The temporary website that accompanied the piece featured a calorie counter where the resulting fitness benefit could be determined.

PFIP is a site specific project, but it can be adopted to other pedestrian-hostile cities. Whereas it grew out of rather personal observations or rather frustrations about a pedestrian-hostile environment, it aims to challenge the perception of our ordinary surroundings and to foster a discourse about urban planning, traffic and political priorities. Like the other projects presented in *Non-Sense of Place*, it does so playfully.

5.9 Project: Speed Gardening Guerrilla

Speed Gardening Guerrilla is a competitive game for teams of players that uses planting as its core game mechanic (Straeubig 2012). To win the game, players plant plants in an urban environment, spy on their opponents, steal their plants and re-plant them in order to create the largest planting spot. The game is usually played in a festival context over a period of several days.

5.9.1 Development

I designed the precursor of *Speed Gardening Guerrilla* in spring 2012 under the name “Gardening Guerilla”. This was done in preparation for a game design class at Leuphana University Lüneburg. My motivation was to create a game that could be played by my students during the whole semester. I also wanted the game to be pervasive, to create some interference between ludic and non-ludic spaces (see Magic vs. Pervasive (p. 128)). As the students were coming to campus only once or twice a week, the game was set to

enable intermittent gameplay, allowing for short interactions at irregular intervals. Another inspiration came from the dynamic nature of real-time strategy games like *Starcraft*, where factions compete for domination on a map that is partially visible to the players (Blizzard Entertainment 1998).

The original rules involved planting sunflower seedlings somewhere within the boundaries of the university campus. The seeds would grow into plants and the teams were required to look after them during a time 6 months. The winner would be the team that raised the largest plant. Players could steal plants of the other teams and re-plant them at the location of their own planting spot.

The growth of the plants automatically creates a game dynamic, and from this conflict emerges naturally. Players are interested to keep the location of their planting spot secret, but they also want to look after their plants, water and tend them to optimise growth. Frequent visits are in risk of revealing the location for the other teams that might spy on and follow their opponents. Also, larger plants are easier to spot and while growing is the goal. I deployed these opposite goals as design elements to create playful tension.

I had to rethink and redesign the game mechanic when the game was commissioned for the Playpublic Festival in Berlin 2012. It was supposed to be played in an inner city setting and could only take three days.⁹ While I considered the growth mechanic to be central, I finally had to abandon it towards an approach with small plants that could be provided by me and by the participants at the beginning of each game. I modified the game rules accordingly. Each time the game was exposed in public, I refined the rule set to adapt to the situation and to the surrounding urban environment (Straeubig 2012).

During a residency at Medialab Prado in Madrid in 2013, I developed a mixed-reality version of the game, by augmenting the plants with QR-codes and creating a smartphone app that would send the GPS position of the plants to a server, displaying them as dots on the facade of the Medialab (Straeubig 2013a).

5.9.2 Exposition

Speed Gardening Guerrilla was initially played in public during the Playpublik urban game festival in Berlin, 2012. One year later I brought it to w00t, a similar festival that took place

⁹This is why I added "speed" to the name, indicating the relatively short running time of three days versus the six months of the original game concept.



Figure 5.5: Speed Gardening Guerrilla at Playpublik Berlin



Figure 5.6: Speed Gardening Guerrilla at w00t Copenhagen

in Copenhagen. Also during 2013, I developed and presented the mixed-reality version of the game at Medialab Prado in Madrid for the “Solid Interfaces and Urban Games: Digital Games in the Public Spaces” project. In June 2014, *Speed Gardening Guerrilla* was invited to the Malta Festival in Poznań, Poland and to the Playful Arts Festival in 's-Hertogenbosch in the Netherlands, where it was run by Frank Loesche.

I presented the project as part of my *Non-Sense of Place* exhibition during the Balance/Unbalance conference at the University of Plymouth in August 2017.

The game rules are published under a non-commercial Creative Commons (2019) license. This implies that everyone is permitted to stage and play *Speed Gardening Guerrilla* on their own behalf, without further permission, restriction or fee, as long as the endeavour itself is not commercial.

5.9.3 Discussion

Speed Gardening Guerrilla began as a pervasive game for students with physical plants as some kind of unusual game material (see Magic vs. Pervasive (p. 128)). Similar live games, some of which include role-playing and hide-and-seek elements, have been played on university and school campuses, for example, the game Killer (Jackson 1998; Davis 2009). Moving from the campus environment of the original game to various city spaces in different cultural and legislative environments has exposed a set of new themes, in particular issues concerning public/private space, legality of Guerrilla Gardening and ethical considerations of playing with organisms.

Speed Gardening Guerrilla could be described a gamified variant of Guerrilla Gardening (Reynolds 2009). Guerilla Gardening began as a movement in the early 70s in New York, when Liz Christy and her Green Guerrilla group created a garden on an abandoned lot (Wilson and Weinberg 1999). I would claim that Joseph Beuys' 1982 piece *7000 Oak Trees* (Beuys 1982), where he playfully “blackmailed” the municipality of Kassel into planting 7000 trees in exchange of removing the same number of basalt stones from a central square, one stone for each tree, also counts as a subverted form of urban gardening. Beuys, however, was effectively using the art system as his executive arm.

Because it involves planting into public or private ground that is not in the gardener's possession, Guerilla Gardening per se is an illegal activity (Hardman 2011). However, how severe is this illegality exactly? This was the question I discussed with my students in

Lüneburg and during game sessions with players and concerned parties.

In Madrid I was told not to plant in plain sight of the police, while in Berlin an encounter with state authorities went well after the players could credibly claim that they were not attempting to steal plants from a nearby bed of roses, but adding plants to the city (Schuster 2012). The application to present *Speed Gardening Guerrilla* in central London during the art game event *Now Play This* was rejected from the festival on grounds of concerns about future public funding — staging the game was deemed too risky for that kind of event (Gramazio 2018).

Then there is the question of whether it is ethical to play with plants, “just for play’s sake”, hinting at an inferior role of play as opposed to activities which have external purposes (see *Play vs. Purpose* (p. 54)). It seems less objectionable for plants to serve as construction material, food or face cream. What difference does it make to play with game pieces that are alive?

Some of these considerations led to practical design decisions. After the first occasions I changed the material for marking the plants; it is now biodegradable. I also consulted specialists to ensure that the plants that I selected for the game were sturdy against replanting. The rules of the game remind the players to treat the plants with respect and avoid any negative impact on the environment.

I think seeking an answer to the ethical questions posed above must go deeper. This brings us back to the distinction between human and animal play and the one between games and art (see *Games vs. Art* (p. 63)). Several contemporary artworks present living beings as artworks, for example Eduardo Kac’s transgenic *GFP Bunny* (Kac 2000; Kac 1998), Anna Dumitriu’s bacterial textile *Plague Dress* (Dumitriu 2018), or Garnet Hertz’ *Cockroach Controlled Mobile Robot* (Hertz 2005).

On the surface these artworks present biological systems from conceptually different angles: Dumitriu uses bacterial DNA and dried plants as historical and metaphorical material. Kac plays artfully with the spectre of genetic engineering, the direct interference with the genetic sphere of the living. And Hertz assembles an electro-mechanical-biological machine-animal chimera.

While the emerging bioart movement is investigating living systems and the artistic handling of various biotechnologies (Yetisen et al. 2015), it appears that the artists are not only responding to ethical considerations about the scientific and technological developments

they reflect but also anticipating possible controversies about the artworks themselves. This form of self-awareness produces an artistic stance that brings along with the artwork a form of already pre-formulated meta-ethics.

Kac (2005, p. 264), for example, frames his work in terms of its social environment by stating that his “[...] artwork ‘GFP Bunny’ comprises the creation of a green fluorescent rabbit [...], the public dialogue generated by the project, and the social integration of the rabbit”. By re-imaging ethics committee debates as performances in “Trust me, I’m an Artist: Towards an Ethics of Art and Science Collaboration”, Dumitriu and Farsides (2014) address procedures around ethical responsibilities that usually remain opaque. Hertz (2002) illuminates distinctions drawn in the context of the Canadian system of research ethics, quoting from the respective guidelines: “On the other hand, insects, crustaceans, and plant organisms don’t fall under the category of being an animal, and therefore research involving these subjects do not to require any form of ethical review”.

That level of artistic appraisal for ethical concerns is in stark contrast to previous works of art, which have produced scandals in regular intervals, using animal cadavers, mistreating living animals or killing animals in the context of the artwork (Vilmer 2009).

Transgressions like Survival Research Laboratories’ machine-corpse installations (Juno, Vale, and Ballard 1987, p. 6-17) or Joe Coleman biting off the heads of living rats during performances (Juno, Vale, and Ballard 1987, p. 180-189) seem to point to the extreme fringe of the art landscape, but established artists are certainly not less capable of staging mayhem. An estimation of how many creatures were killed in the creation and display of works by British artist Damien Hirst alone arrived at a total number of 913450, including a few sharks, some sheep and a large number of houseflies (Goldstein 2017).

Controversial outcomes of artistic processes — scandals — make events within the art system *anschlussfähig* for other events, as provocations (compare Discussion (p. 131)), as topics of conversation between artists, curators and audience and as publications. They also potentially irritate other subsystems of society like the legal system, mass media or activist groups concerned with animal rights. This can be observed in the example of Guggenheim’s exhibition “Art and China after 1989: Theater of the World” where in the wake of a scandal first an attempt at communication is made (Solomon R. Guggenheim Foundation 2017a) followed by an act of self-censoring after threats of violence (Solomon R. Guggenheim Foundation 2017b). The art system itself can deal with negation as an

enabler of new communication (Luhmann 2000, p. 283).

Some contributions from the field of design and human-computer interaction cross similar ethical boundaries (Sareen, Zheng, and Maes 2019). In this project, as well as in a related one by (Stavriniidou et al. 2015), technological possibilities are investigated without mentioning any possible concerns for the living research objects. Donna Haraway (1997, p. 97) has identified this attitude in the established tradition of science: “Nineteenth century scientists materially constituted the organism as a laboring system, structured by a hierarchical division of labor, and an energetic system fueled by sugars and obeying the laws of thermodynamics. For us, the living world has become a command, control, communication, intelligence system [...]”.

One difficulty in developing an ethical perspective towards plants may lie in the fact that presently there is a wide disagreement about what would constitute “plant rights” based on their cognitive and emotional faculties, exemplified in the diametrically opposed opinions of (Pelizzon and Gagliano 2015) and (Taiz et al. 2019). As long as legislation makes a distinction between animals and plants, researchers and artist can recourse on the distinctions that the legal system and the respective ethics committees draw.

I would hold against this view that an ethical stance has to permeate any legalistic argumentation, considering the distinction between legal vs. illegal and ethical vs. unethical. I believe that in the wake of a growing body of findings about cognitive, emotional and social qualities in plants (Wohlleben 2016), these kinds of experiments could at least be discussed critically. As opposed to postmodern art or play for play’s sake, research in human-plant interaction may claim beneficial purposes (Play vs. Purpose (p. 54)), although I cannot see them in the projects referenced above.

The earliest recorded instance of bioart actually contributed to the welfare of society, although it did so involuntarily. The biologist and physician Alexander Fleming painted with bacteria in Petri dishes in between experiments, when he noticed that some of his works had been destroyed by a fungus. This triggered the discovery of Penicillin (Yetisen et al. 2015). As the original intentions for Fleming’s “germ paintings” were of a frivolous kind, would the accidental discovery still count as ethical or make up an act of “microslavery” (Harvey et al. 2014)? Intention and effect can go in the other direction as well. When Hans Haake (2010) set free ten turtles into the French wilderness in an attempt at an artistic critique of the pet trade, he picked the wrong subspecies. As a result, his well-meant

intervention “was likely to have compromised genetically distinct lineages of both tortoises and threatened the biodiversity of Hermann’s tortoises” (Yetisen et al. 2015, p. 727). In Luhmann’s terms, an act of irritation happened between the social system of environmental art and the biological system of that population (Luhmann 1996, p. 210-254).

Thus, should we regard intention as an ethical measure for these projects? (van Eck and Lamers 2018) argue that games involving organisms should either serve educational purposes such as to “spark interest into biology in a playful way” or be “used as a medium to express artistic statements about, among others, animal experimentation and the relationships between species”¹⁰ (van Eck and Lamers 2018, p. 7). Undeniably, aside from its playful and discursive aspects, playing Gardening Guerrilla results in more plants being added to the urban landscape. This can be considered a positive ecological contribution, albeit a small one.

Does *Speed Gardening Guerrilla*, events where players roam inner city streets to find suitable planting spots, then rather qualify for educational value or as an artwork? In general this is a difficult question (compare Games vs. Art (p. 63)), but it can be resolved by observing the distinction between the first and third person perspective (see Paradoxa of Play (p. 69)). The players might play for their frivolous pleasure, whereas the game itself might reveal more serious themes that are reflected within the Guerrilla Gardening movement.

Reynolds (2009) describes several motivations for this form of urban gardening. He suggests that some gardeners like to improve the aesthetics and health of neglected places, some prefer to plant edible varieties for increased self-sufficiency, and others enjoy the identity-building expressiveness of rebellious gardening, support the movement in its political aims or seek a community of like-minded people. These motives can be considered playful, arguably even the goal of harvesting, considering Suits definition of a game as a system where the rules prohibit the use of more efficient means (see What Is Play? (p. 15)). In comparison to traditional gardening, a Guerrilla Gardener undertakes additional effort and risk in order to reap benefits from urban plantations. Michael Hardman (2011) illustrates the social process of group forming and disbanding, referring to models of the social theorist Alberto Melucci (1996). Like other forms of play, Guerrilla Gardening is a social system.

¹⁰In 2011 I presented a game called 20000 Nanometers under the Sea at the AR Devcamp in Düsseldorf which involved yeast cells and Crustaceans (Straeubig 2011). My ethical self-vindication was that the species that I bought in aquaria stores was used as fish food anyway.

Can art give impulses for an audience to act in an environmentally aware manner? In an empirical study, Laura Sommer and Christian Klöckner give a positive answer, noting that artworks that represent “beautiful and colorful depictions of sublime nature that are showing solutions to environmental problems” are most likely to stimulate positive action (Sommer and Klöckner 2019). I think it is necessary to note that their conclusions are based on answers that their participants gave in a questionnaire, not on actual actions taken. Yet I cannot claim that any of my own projects would fit this description. In light of the wide-scale destruction of the planet in the Anthropocene, a strategy for artworks like (Uribe 2019) is to seek refuge in irony. It is rather this kind of artistic stance that is reflected in both of the previously discussed projects, *Pedestrian Fitness Initiative for Plymouth* (see Project: Pedestrian Fitness Initiative for Plymouth (p. 135)) and *CO2rwall CO2 Challenge* (see Project: CO2rwall CO2 Challenge (p. 130)). Next, I will discuss the three projects in the context of systems playing with the system vs. environment distinction.

5.10 System vs. Environment in Practice

The three projects discussed in this chapter present playful systems that thematise the distinction between system and environment. Each of them draws this distinction differently.

The streets, yards and buildings of a city are located in the physical environment of a pervasive game like *Speed Gardening Guerrilla*, as much as the legal system is located in its societal environment. The discourse around the lawfulness of planting in public ground that is surrounding Guerrilla Gardening has accompanied the development of the game, from the initial discussions with my students to the rejection from a festival for fear of losing funding.

The *CO2rwall CO2 Challenge* and *Pedestrian Fitness Initiative for Plymouth* work with an ironic reversal of positions, similar to *Hostile Environment Facility Training* (see Project: Hostile Environment Facility Training (p. 40)). Instead of positioning themselves as a predictable opposition, they offer critique through affirmation. This only works if the irony can be observed by the audience, otherwise the pieces risk failure in the traditional sense of the art system (Luhmann 2000, p. 5-53).

In this respect, the *CO2rwall CO2 Challenge* is probably my most ambivalent piece. Its interpretation of data on man-made CO2 production is close to the rhetoric of climate

denial, and an observer could interpret it as such. However, in my opinion the production of art is prone to be misunderstood, and in contrast to science, the artistic intention is to keep this option as a selection for the audience.

5.11 Summary: Change of Perspective

In this chapter I have addressed how a system can be observed as a unit, through the distinction between system and environment. I have discussed the significance of the observation that phenomena of play may be a result not so much of the system that plays but of its environments. This has some deep implications for designing playful systems, as it shifts the focus from designing systems to architecting environments (see *Architecting Environments* (p. 126)).

Furthermore, I have discussed examples of pervasive games that deliberately irritate this distinction, and offered three of my own projects as examples for testing boundaries between systems and environments in a playful manner (see *Project: CO2rwall CO2 Challenge* (p. 130), *Project: Pedestrian Fitness Initiative for Plymouth* (p. 135) and *Project: Speed Gardening Guerrilla* (p. 138)).

Throughout this thesis I have observed different observers of play, by means of analysis, reference, quotation and through offering my critique, in other words: I have engaged in second-order observation. Second-order observation was introduced into cybernetics through the distinction between an observer and the observed (see *Von Foerster: Second Order Cybernetics* (p. 29)). It provides a method to resolve contradictory accounts and to make sense of play (see *Requirements for a New Paradigm* (p. 24)). It does not, however, open up to the phenomenological qualities of the immediate first-person perspective. Reading about someone else's experience is not equivalent to my own experience. To encounter the qualities of direct experience, a different mode is required that brings us in contact with the phenomena under investigation: practice.

In the medium of this text, however, I can only communicate my experience by describing it in a self-referential second order observation: through reflection. In the following chapter I therefore return to questions of observation, in particular to the distinction between theoretical and practical ways of sense-making. This will also require this thesis to engage in a critical observation of itself and to reintroduce the distinction between itself and its

environment (Vanderstraeten 2001).

Chapter 6

Theory vs. Practice

Play transcends all disciplines, if not all discipline.

Mihai Spinosu (1989)

6.1 A Third Culture?

In his famous observation about “the two cultures”, C. P. Snow (1993) deplored the lack of communication between the sciences and the humanities. He also expressed his hope that some form of third culture would emerge, bridging the gap. This appeal has encouraged others to engage in overcoming the disparity between intellectuals and scientists.

Some have argued for the emergence of a third culture, instigating discourse between modern thinkers (Brockman 1996). However, their stated philosophy is rather science — and US-centric than dialectical and interdisciplinary. The third culture that Snow envisioned, I contend, cannot arise by acting out an inferiority complex towards the humanities, but by enabling transdisciplinary discourses and by raising the potential for *Anschlussfähigkeit* (see Requirements for a New Paradigm (p. 24)).

This is the anti-entropic principle of von Foerster’s ethical imperative. It reminds us to create more distinctions (see Von Foerster: Second Order Cybernetics (p. 29)). Therefore I caution against eliminating differences, be it under the umbrella of scientific grand unifying theories, the postulate of pan-theistic principles or the simplistic dictum of reductionist efforts.

I have discussed in section Definitions vs. Distinctions: What Is “Is”? (p. 23) that dichotomies like science vs. humanities, cybernetics vs. AI, brain vs. mind, play vs. work

and narratology vs. ludology provide these opportunities for communication, if they are observed as distinctions. Then we can observe and cross them; they become available for further discourse and they enable observing new distinctions, observers, systems and environments.

In this chapter I am returning to the two modes of investigation in my project, its theoretical and its practical side. I have argued from the outset that both are needed for a comprehensive description of play (compare Requirements for a New Paradigm (p. 24)). Later I have discussed how my own practice and theoretical thinking have informed each other through the projects presented in sections Project: Hostile Environment Facility Training (p. 40), Project: Spiel 1 (p. 57), Project: Imperfect VR (p. 74), Project: Neurotic (p. 100), Project: KlingKlangKlong (p. 110) and Project: Non-Sense of Place (p. 130). Now I want to reflect on the distinction between theory and practice itself.

Theory and practice also represent two cultures. One is a culture of thinking and reflecting, the other a culture of making and experiencing. In my *practice informed research / research informed practice* (see Play and Discipline(s) (p. 151)), both are linked by communication: lectures, discussions, documentation, exposition of practice and publications. In order to observe theory and practice as a distinction in this chapter, via reflection, it is necessary to mention two concepts: reflection and re-entry.

The first one is reflection itself. According to Luhmann, it involves a form of self-observation that rests on the distinction between system and environment (see System vs. Environment (p. 123)). With reflection, a system is able to observe itself as a unity (Luhmann 1996).

By observing the distinction between theory and practice through theoretical reflection, this chapter also represents a re-entry (see Discussion (p. 114)). Here, this thesis represents the system, observing its own code, which is the distinction on which it is based through one side of this very same distinction, its theory. For this operation to succeed, it has to reflect, that is to observe itself as a system against the background of its own environment. The environment consists of the academic disciplines, their methods and practices, and

how they are observing play. This is the topic of the next section.

6.2 Play and Discipline(s)

In previous chapters, I have both observed play and discussed how play is observed by different academic disciplines. We can observe the development of a significant number of theories and practices regarding play itself as an artefact of the processes that produce knowledge within the humanities and the natural and social sciences (Luhmann 2009). These different disciplines also observe each other. The macrostructure of the scientific system has been described as a dynamic process that is oscillating between mainstream agreement, diverging observations and disrupting subversion (Kuhn 1962). By observing scientists at work from a sociological perspective, Bruno Latour (1999b) noticed that their operations are constructive rather than an “objective” analysis of empirical observations. In the same tenor, I have argued in section Play vs. Purpose (p. 54) that implicit assumptions permeate the mechanisms of observation. Scientific play research still is strongly associated with its academic roots in psychology, ethology and anthropology. Until now, its observation of human play also heavily leans towards children.¹

Most importantly, science cannot escape its own methodology, which requires the preparation of experiments, including the physical environment, the laboratory, the experimenters, the subjects, the protocol and the interpretation of the observations in form of observational codes. Ostrov and Hart (2014) show how environments influence what can be observed within their boundaries. This relates not only to the production but also to the consumption of scientific results (Weisberg, Taylor, and Hopkins 2015). Based on the discussion in chapter System vs. Environment (p. 123), we can understand science as a social system, an environment for experiments, scholarship, discourse and interpretation. I have used Tinbergen’s four questions to illustrate how scientific descriptions operate with the a priori assumption of utility (see Play vs. Purpose (p. 54)). These programs remain highly relevant as they are guiding a new wave of behaviourist research, with machines in place of animals (Rahwan et al. 2019). Recent directions of research in both ethology (Reinhold et al. 2019) and artificial play (Perotto 2013) show promising “confusions” between biological systems and machines: rats seem to enjoy play without being rewarded with food, machines pick up complex tool use through multi-agent competition.

¹This becomes evident considering that the first academic journal for adult play was only founded in 2019 (see <https://www.journalofplayinadulthood.org.uk>).

In the following two sections, I will reaffirm my standpoint that in order to make sense of these developments, the observation of different types of systems (see Luhmann: *Distinctions Create Meaning* (p. 33)) is crucial. Not least because of my own practical explorations (see *Project: Neurotic* (p. 100) and *Project: KlingKlangKlong* (p. 110)), I have come to the conclusion to put more focus on social systems instead of biological ones. My scepticism towards the prevalent scientific discourses, however, does not fundamentally discard their utility. We can imagine for a moment that science would cease to reaffirm the usefulness of play for the learning and development of children (see *Play vs. Learning*). In the context of our current meritocratic system,² would there be still convincing arguments against abolishing play altogether? Why then not let children be occupied and economically useful at the same time? Traveling further along this line of argumentation, wouldn't it be even a moral imperative to abandon play in favour of productive work that would contribute tangible results to the welfare of society?

I do not promote to leave scientific views on play aside. Rather, I suggest moving towards a transdisciplinary position (compare *Requirements for a New Paradigm*) which requires observing the other side of the two cultures as well. Contributions from the humanities (Schiller 1795; Huizinga 1955; Caillois 1961; Spariosu 1989; Sutton-Smith 1997) call for the re-location of studies of play from their currently predominantly scientific boundaries. As a cultural phenomenon and as an aesthetic dimension, play deserves to be reflected in the humanities and the arts as much as in the explanation-seeking sciences.³

By providing “gaming literacy”, the ability to read games in a way the *feuilleton* would traditionally interpret works of literature, music, performing arts and film (Zimmerman 2009), the fledgling field of game studies has promised an opportunity for interdisciplinarity. Indeed, there is evidence that play as a subject of research is welcome in game studies. For example, consider recent discourse manifest in a series of academic panels (Mäyrä, Lammes, et al. 2015; Mäyrä, Arjoranta, et al. 2016). Yet the field's rooting in media studies still mainly focuses on the observation of games as cultural artefacts (for example: (Simons 2007)). This is considerably evident in the ongoing debate about the relationship between video games and other forms of narrative (compare *Ludus vs. Narratio* (p. 85)).

²Meritocracy is the ideology of performance, a belief in the benefit of effort and achievement (Young 1994). This concept is different from capitalism, where wealth is created without involving personal labour through the inception and growth of capital.

³As long as we draw the distinction between the humanities and the sciences, scientific disciplines appear monolithic through a shared understanding of methods. This observation breaks down when disciplines like psychology and ethology observe each other (for an example see Pellegrini (2009)).

In line with Kuhn (1962), the ludology vs. narratology debate can be interpreted as the emancipation of game studies as a field in its own right, with the ludic position as the new paradigm. In my view, the debate has served as a founding myth of game studies but the field finally needs to decide if it accepts that distinction as its code (see Discussion (p. 114)) or if a more useful distinction like play vs. games can bring new insights instead of continued repetition of arguments. Fresh perspectives also could be provided by critiquing the transition from film as the previously dominant medium (Denson and Leyda 2016).

A second observation goes against the idea that game studies are embracing play studies: discussions within the field are becoming even more particular which seems to have settled on video games. Scholar Sebastian Deterding (2016, p. 1) is expressing this concern explicitly: “[. . .] instead of establishing themselves as the broad umbrella interdisciplinary of digital game research, they are becoming one narrow cultural studies multidiscipline within the growing and diversifying field of game research and education”. It is notable that Deterding is afraid that the game studies are not even capable of covering relevant aspects of digital games. How would it then be able to discuss wider topics of games and play?

Various scholars have attempted to clarify their positions towards games vs. play and digital vs. analog media, but these accounts are often conflicting. Proclaiming the beginning of a new discipline of modern game studies in July 2001, Espen Aarseth (2001) has insisted on computer games exclusively. Gonzalo Frasca (2007) discusses play, games, video games and toys, Miguel Sicart (2014) stresses the relevance of play. Mari Erika Koskela (2016) proposes a model in which play sits at the centre of three overlapping concepts, game, player and context. The Handbook of Computer Game Studies (Raessens and Goldstein 2005), published in 2005, seeks to cover a wide range of aspects: history and future of games, game design, reception and psychological effects of video games and games as aesthetic, cultural and social phenomena. I doubt that nowadays it would still be possible to fit the far more differentiated and controversial perspectives about games into one volume.

Another fundamental aspect of a discipline other than its objects of study concerns its methodologies. Lankoski and Björk (2015) enumerate qualitative methods to study games, play and players, quantitative approaches, mixed methods and game development for research. Most of the methods in the first two categories are empirical, and they are

imported from the natural and social sciences, alternatively from media and cultural studies. Mixed methods combine qualitative and quantitative approaches, yet do not transcend their disciplinary toolbox. An important question for empirical methods is the location of the collected data. Expanding on (Stevens, Satwicz, and McCarthy 2008), Lieberoth and Roepstorff (2015) enumerate four different levels: in-game (avatar movement), in-body (measuring biological signals from the player), in-room (observing the player) and in-world (from the environments of play). In mixed methods, any of these observational approaches can provide streams of information that then can be combined and analysed.

There are many issues, however, that these methods largely cannot address. This concerns phenomenological access to the first person perspective, research through practice, transdisciplinary approaches and exploratory research in which questions, methods and answers are emerging during the process itself. To address these perspectives, I am crossing to the issue of practice in the next section.

6.3 Towards Play Design as Research

Practice as a contribution to knowledge has found its place in certain academic disciplines (Barrett and Bolt 2010), including art and design (Schwab and Borgdorff 2014). Corresponding methodologies have been called “research by design” (Frayling 1993; Friedman 2008), “design-based research” (Herrington et al. 2007) or “performative research” (Hase-man 2006). Practice-based methods are different both from scientific approaches and from theoretical investigations undertaken in the humanities, but they are informed by both (Mateas 2001). Essentially, only practice-based methods can expose phenomena to the researcher in the first person perspective, where they are available for methods such as autoethnography (Ellis, Adams, and Bochner 2011). An example is Jarvinen’s investigation of games via his own play practice that he calls “applied ludology” (Järvinen 2008).

I have described the paradoxical distinction between games and play in section Play vs. Games (p. 65). By crossing this distinction with the distinction between theory and practice, I can now view play design to denote practices that includes game design, but also embraces designing toys, facilitating playful interactions and architecting playful environments (see Architecting Environments (p. 126)). By understanding play as a medium (see Play vs. Games (p. 65)) play design becomes an analogue to practices like

visual design, audio design and object design. This raises questions about the availability of knowledge for play design.

In the wake of the economic and cultural rise of video games, an extensive body of knowledge on how to design and develop digital games has been produced (Salen and Zimmerman 2003; Schell 2015; Hunicke, LeBlanc, and Zubek 2004). Game design involves research, ideation, development of game mechanisms and narrative content, prototyping (Houde and Hill 1997), simulation, playtesting, and documenting. Game development transforms designs into physical or digital artefacts. Lankoski and Holopainen (2017) have collected a variety of practice-based methods in game design research, where game design appears both as a method and as the object of research.

In conclusion, play design still sits at the cracks between academic disciplines and design practices. For a long time, play has been observed as a phenomenon in contrast to games that are considered being artefacts to be designed and built. Salen and Zimmerman point out that game design is the indirect design of a player experience through the game rules (Salen and Zimmerman 2003). Complicating matters even further, games and play are considered being in a paradoxical relationship, as discussed in section Play vs. Games (p. 65). I contend that the methodology presented in this thesis has shed light on these problems, as play can be observed from different angles in the environment of games, while we can understand games as a medium for play (see Play vs. Games (p. 65)). A description for my approach that has emerged from practices described in section Mateas and Schwab: Artistic Research (p. 38), is *research informed practice / practice informed research*, which denotes a dual nature without preference for one mode or the other.

With the conceptual frame of Friedman (2008), my practice can alternatively be described as an inquiry into the reality of play (compare Constructivisms vs. Constructionisms (p. 30)). I have approached research questions by designing and developing prototypes without a complete analysis and discussion of underlying hypotheses, theories or models. Instead, I let the prototypes (Houde and Hill 1997) and their expositions guide my further research (compare Mateas and Schwab: Artistic Research (p. 38)). In this way I developed *neurotic* (see Project: Neurotic (p. 100)), *CO2rnwall CO2 Challenge* (see Project: CO2rnwall CO2 Challenge (p. 130)) and in particular *KlingKlangKlong* (see Project: KlingKlangKlong (p. 110)). This approach leads to a (not necessarily asymptotic) approximation to my research question and sometimes — as described in section Discussion (p. 102) — to a

reorientation of both practical and theoretical assumptions.

While irritating (see Luhmann: *Distinctions Create Meaning* (p. 33)) both the game studies and the practice of design for play and games in their own autopoietic processes of differentiation, I propose a transdisciplinary stance, one that goes beyond a singular discipline and keeps it connected to other disciplines via distinctions instead. This position, I argue, has benefits to it, as it avoids the same, self-repeating discussions renegotiating the identity of disciplines as encountered in section *What Is Play?* (p. 15). At the same time it carries a risk, because the academic system normally does not foster directions it cannot classify into established disciplinary compartments.⁴ One strand of hope rests on a renaissance of the constructivist, cybernetic and systems-theoretic foundations that have inspired and scaffolded my research (compare *Distinction vs. Identity*).

6.4 Designing Playful Systems

A central theme of this thesis is the methodological replacement of definitions by distinctions. Instead of defining concepts in order to work within their boundaries (see *Definitions vs. Distinctions: What Is “Is”?* (p. 23)), I am playing with a set of distinctions, following a path through the space of possibilities, actualising some of them while virtualising others (see *Actual vs. Potential*) while encountering contradictions and strange loops (see *Requirements for a New Paradigm* (p. 24)).

Eric Zimmerman (2014b) characterizes a playful system as “[...] a human system, a social system rife with contradictions and with possibility”. In consequence, designing playful systems does not follow pre-written procedures. Instead, it can be construed as a laboratory in the making, an environment for construction and experimentation (see *System vs. Environment* (p. 123)) that is reproducing its own *Anschlussfähigkeit* (see *Requirements for a New Paradigm* (p. 24)). Likely outcomes are rather a plurality of projects, methods, publications, research, failed experiments (compare *Project: Neurotic* (p. 100)), performances, hacks, strange loops.

The following seven directions for designing playful systems should therefore not be read as a categorisation, but rather as potentials to be actualised, resulting from my current constructions and decisions to observe particular distinctions and not others. These

⁴I therefore consider my own doctoral program, the EU-funded Marie Curie Initial Training Network Cognovo as an exceptional effort in producing novel approaches to creativity and cognition.

directions and the requirements set out in section Requirements for a New Paradigm (p. 24) form another strange loop as both emerging from my *practice informed research /research informed practice*.

6.4.1 Anthroponeutral Design

Mary Flanagan (2013) proposes radical game design as a methodology which is centred around a set of values while keeping the process iterative and open for subversion. In a similar vein, each playful system I designed as described in the previous chapters has been constructed or re-contextualised based on distinctions. Through the distinction between human and machine (see Human vs. Machine (p. 97)), I developed the concept of anthroponeutral design for play that is intended for humans, animals and machines alike.

This principle neither celebrates Schiller's idealistic humanism of play (see Can Machines Play? (p. 97)) nor denies human participation in a pure training environment for artificial intelligence. Instead, it is agnostic about its players, observing play with a xenofeminist distance (Laboria Cuboniks 2018) and aesthetics (Konior 2016). Michelle Westerlaken (2017) is investigating the related concept of non-speciesism, developed from the distinction between theory and practice and between human and animal players (Westerlaken 2016).

The design of *KlingKlangKlong*, discussed in section Project: KlingKlangKlong (p. 110), has been deliberately anthroponeutral. This approach intentionally renders distinctions between the virtual and human participants of play invisible. As the game takes place in virtual and in physical space, it is still possible for human players to detect virtual players, which a future design could strive to avoid.

6.4.2 Autopoietic Machines

Beginning in the mid-1970s (Varela, Maturana, and Uribe 1974), there have been attempts to formalise the concept of autopoiesis in a minimal model (see Maturana and Varela: Perception Is Distinction (p. 32)). Some of these approaches are developed in the context of artificial chemistry (McMullin 2004).

Subsequent research has modelled further aspects of autopoiesis, such as the system vs. environment distinction modelled in Conway's Game of Life (Beer 2004). Game of Life is

a formal system with a minimal set of rules that is Turing-complete, which means that it has the same representational strength as any general computer (Rendell 2011). This allows the observation of strange loops between genetic and developmental processes (Caballero, Hodge, and Hernandez 2016). Beer's critical discussion of the question of whether a glider, a simple self-replicating structure, can be considered being autopoietic, reveals the limits of formal models of solely biological systems.

As I have discussed in section Luhmann: Distinctions Create Meaning (p. 33), Luhmann's concept of autopoiesis extends to minds and social systems. I believe that it is a promising route to shift the paradigm in game design from complex to autopoietic systems. This direction of research is actively investigated by (Iba 2010) and by (Bishop and Al-Rifaie 2016a; Bishop and Al-Rifaie 2016b), who apply autopoietic systems to various aspects of creativity (compare Play vs. Learning (p. 56)).

6.4.3 Future Things

Designer Donald Norman (2007) discusses how technology and humans are becoming increasingly intertwined. Distinguishing reflective, behavioural, and visceral levels of reaction, Norman insists that designing for products and services involves developing a psychology of people and machines. Future things in this sense can be toys, machines, species or other systems that are designed to observe each other playfully.

Within a technoculture that approaches systems as artistic, ludic and playful, creating opportunities for magic circles that may involve artificial and biological systems, like reactive robotic toys for cats (Sprite Robotics 2015) or playful ecological social systems like *Biomodd* by Angelo Vermeulen (2007): “Biomodd is a multifaceted socially engaged art installation that finds meaningful relationships between biology, computers and people”. Beyond the artefacts that are created in a project like *Biomodd*, social systems emerge and develop, transcending and superseding the “thingness” of things⁵.

6.4.4 Imaginary Objects

Artist and Designer Bruno Munari (2008, p. 203-207) describes a method of “theoretical reconstruction”, borrowed from archeologists who recreate missing parts of a find. Applied

⁵This is one reason why I have argued against thing-oriented ontologies (Bogost 2006; Bogost 2012) in favour of system theories (see the footnote in section Luhmann: Distinctions Create Meaning (p. 33))

to imaginary objects, this approach involves starting from some given finding and then extending it into our imagination. This is what I was attempting to do by re-purposing the car-centred traffic ideology in Plymouth (see Project: Pedestrian Fitness Initiative for Plymouth (p. 135)), reshaping concerns about the global climate crisis into surreal exercises (see Project: Cornwall CO2 Challenge (p. 130)) or turning a governmental Hostile Environment policy into a *Hostile Environment Facility Training* (see Project: Hostile Environment Facility Training (p. 40)).

Munari's design process is initiated by physical objects, whereas the findings in my projects are actualisations of the virtual (compare Actual vs. Potential (p. 83)), constructions within social systems rather than the material objects symbolising them. Some of these virtualized things re-materialise in physical props like the metal barriers and tactical vests of *HEFT* (see Exposition (p. 42)). In each of these projects, the re-construction is playful, liminal, and keeps some distance from its subject through irony and shifts of perspective.

6.4.5 Expressive Design

I have described Michael Mateas' concept of expressive AI (Mateas 2001) (see Mateas and Schwab: Artistic Research (p. 38)). I propose to extend this idea to areas outside of artificial intelligence: expressive design stands for applying disciplinary methods and techniques while offering critique towards the purposes inherent in that disciplines (compare Play and Discipline(s) (p. 151)).

We can find related conceptual traits in Haseman's performative research (Haseman 2006), Pickering's mangle of practice (Pickering 1995), Schwab's experimental systems (Schwab 2014) and Marenko's speculative *FutureCrafting* (Marenko 2018).

All these methodologies critique and subvert through a viewpoint of artistic practice that playfully undermines both their targets and obsolete understandings of art (see Games vs. Art (p. 63)). Once again (compare Future Things (p. 158)), they render the artwork as artefact insufficient, the thing merely serves to reveal purpose, the subverted one as well as the artistic one. These methods invite to play with the hiding and revealing of descriptions, meta-information, explanations, and documentation of construction. Throughout my project, I have been playing with expressive design as a form of research in order for my theoretical and practical contributions to inform each other.

6.4.6 Experiential Architecture

In chapter System vs. Environment (p. 123) I have pointed out the importance of playgrounds, physical and experiential environments in which play takes place. I have also emphasised that players are free to appropriate their surroundings for play even in the face of a hostile environment.

Salen and Zimmerman argue that game design is indirect design, where the designers create rules while anticipating the experience of the players (compare Towards Play Design as Research (p. 154)). Similarly, the approach of architecting environments (see Architecting Environments (p. 126)) attempts to anticipate forms of interaction that allow for play, representing a shift from the focus on the game, player, or toy within the environment.⁶ Rather, experiential architecture exemplified in the work of the collective Omsk Social Club is concerned with the boundaries of playful systems, creating for phenomena like pervasiveness, bleed and magic circles (see Magic vs. Pervasive (p. 128)). The constructive nature of perception (see Constructivisms vs. Constructionisms (p. 30)) enables experiments like The Unlimited Corridor (Matsumoto et al. 2016), a liminal space where two distinctions are crossed in virtual visual and physical haptic perception. Applying von Foerster's ethical principle (see Von Foerster: Second Order Cybernetics (p. 29)), I believe that both mixed reality and pervasive environments (see Virtual vs. Physical (p. 79) and Magic vs. Pervasive (p. 128)) are promising directions, allowing for novel combinations of physical and digital elements to create rich experiential surfaces.

Both *KlingKlangKlong* (see Project: KlingKlangKlong (p. 110)) and *neurotic* (see Project: Neurotic (p. 100)) combine physical space (more precisely: the relative location and movement of the subset of physical players) with digitally constructed logic and aesthetics. *Spiel 1* (see Project: Spiel 1 (p. 57)) and *Hostile Environment Facility Training* (see Project: Hostile Environment Facility Training (p. 40)) utilise technology to transform a performative physical space into playful environments. And finally, *Imperfect VR* (see Project: Imperfect VR (p. 74)) strives to enable a new generation of creators to become experiential architects.

⁶Inevitably players will subvert these anticipations, which – if expected – creates new strange loops between anticipations.

6.4.7 New Social Systems

I envision a future society that is not controlled by artificial intelligence, but one where humans and machines can communicate with each other. Going back to the distinctions between systems (see Luhmann: *Distinctions Create Meaning* (p. 33)), this means that we must aim to construct new social systems. I have argued in (Straeubig 2017a) that a large amount of work — creating agency-enabling ludic interfaces (Jahrmann 2011) — and experimentation (Jahrmann and Felderer 2013) is necessary in order to enable machines to take part in playful social systems.

Over 30 years ago, Steve Woolgar (1985) observed a substantial need for talks between sociology and AI, an assessment that has lost none of its relevance. A practical effort towards social systems has been made by the *Hitchbot* project (Smith and Zeller 2014) by exposing a robot to extensive hitchhiking tours in three countries (Smith and Zeller 2016). The project's clever reversal of discourses about social trust is to investigate the question if robots can trust humans (the answer is that they can't, as the robot was vandalised during its tour in the USA).

I argue that a key for future social systems that will include machines and humans is research into communication, which I contrast with the prevalent focus on information transmission and natural language processing within the field of computer science (Straeubig 2020b, (to appear)). A promising, practical approach in my opinion is the four-sided communication model of Friedemann Schulz von Thun (1981) that integrates concepts from Bühler's Organon model (Bühler 2011) and Watzlawick's distinction between content and relationship of messages (Watzlawick, Bavelas, and Jackson 2014). In this model, each act of communication has four sides, both for the sender and for the receiver of messages: facts, relationship, self-presentation and appeal. These four facets or subtexts appear in almost every message and can be observed and analysed individually, regarding their relative emphasis or in terms of their congruence.

From the perspective of the sender, the factual side contains the actual subject of the message. The self-presentation side carries both intentional (self-promotions) and unintended (self-revelations) expressions of the sender. These themes are elaborated further by Erving Goffman (1990b) in his observations about play and acting in social encounters. The relationship side encodes how the sender views the receiver and the relationship between them. Finally, each act of communication also carries appeals — these are actions that

the sender intends for the receiver to carry out.⁷ Appeals can be communicated openly (for example, advice or a command) or hidden (manipulation). I am convinced that only by considering all four sides will we be able to construct communication with machines in the future.

6.5 Summary: A Strange Loop

In this chapter, I have returned to the code (see *A Third Culture?* (p. 149) and Discussion (p. 114)) of this thesis, the distinction between theory and practice. By re-entering this distinction on the side of theory, I have proposed guidelines for a future anthroponeutral design, providing opportunities for *Anschlussfähigkeit*. Seen through the distinction between theory and practice, they complement the seven requirements proposed in Requirements for a New Paradigm (p. 24).

In other words: I have arrived again at my starting point, but the starting point itself has transformed significantly. Through playing with numerous distinctions, it is now offering a plethora of new connections that invite further investigation to be continued in theoretical and practical ways. The journey itself now reveals itself as a strange loop, a Moebius strip (see *What Is Play?* (p. 15)) that has “research informed practice informed” written on it (see *Meta-thetical Dialog* (p. 165)). The apparent nonsense becomes meaningful through the topology of the strip. It can then be read either way as “research informed practice” or as “practice informed research”.

This conclusion suggests that I have reached a position where I can stop describing the observations to be discussed in this thesis and look ahead instead. This is the final point I will address in the following conclusion and outlook.

⁷In terms of Bogost (2010), this could be called the “persuasive content” of the message. It is crucial to note that in Schulz von Thun’s model, every message includes this aspect.

Conclusion and Outlook

Life is a game. Live accordingly.

Bernhard Suits (1967)

Coda: Making Sense of Play

How can we make sense of a complex and paradoxical phenomenon such as play? In this thesis, I have undertaken a journey to find an answer to this question. My approach was to develop a systems-theoretic approach to observe play in theory and practice from a wide range of perspectives through the medium of distinctions.

In chapter Distinction vs. Identity (p. 15) I have argued that current discourses are incapable of reflecting the complex nature of play, contributing to its previously postulated ambiguity. In the course of my PhD project I have constructed a methodology of observation on the fundament of prior contributions from systems theory, radical constructivism and cybernetics. I have constructed a network of distinctions between distinction-based theories from Spencer-Brown through cybernetics and radical constructivism to Maturana /Varela and Niklas Luhmann.

I could have made different choices in the context of different epistemological traditions. It would be interesting to compare and contrast other difference-based approaches from proponents like Bateson and Derrida. Adopting terms from Jung (1961), Bateson and Bateson (2005) locate distinctions in the mind (“creatura”), as opposed to the realm of physics, a mindless nature operating with continuous forces and energy (“pleroma”). Derrida (1973) has coined the notion of “différance” as an expression of the strange loops introduced by it.⁸ Adorno has been characterised to emphasise the significance of “non-identity of concept and object, mind and matter, the individual and society” (Cook 2008).

⁸Derrida (1973, p. 259) saw play not as difference, however: “The concept of play [jeu] remains beyond this opposition[...]”.

May (1997) and Gangle (2013) point to a significant number of theories of difference.

My practical approach turns out to be similar to Laruelle's claim for a performative non-philosophy, although both origins and conclusions appear entirely different: critique of philosophy leads Laruelle to non-philosophy while critique of disciplines takes me to transdisciplinarity (compare *Play and Discipline(s)* (p. 151)). Both Laruelle and I start from a critique of identities and definitions (see *Definitions vs. Distinctions: What Is "Is"?* (p. 23)). However, driven by a desire to transform systems "alchemically" into more playful ones (Slavin 2014), I am operating with and through distinctions whereas Laruelle apparently attempts to deny them altogether (Galloway 2014). In a strange loop, he arrives at an essentialist, immanent metaphysical, radical equality he calls "the One" (Laruelle 2010). With Laruelle I am convinced that practice is an absolute necessity; in contrast to Laruelle I am backing up this necessity with a distinction. As I have argued in section *Requirements for a New Paradigm* (p. 24), practice is the mode where the first person perspective comes alive through playing, creating, observing, iterating on playful systems. By discussing my approach versus Laruelle's, I am observing distinctions. Each methodology necessarily requires and autopoietically creates its own distinctions, selections, observers, practice, transdisciplinarity and *Anschlussfähigkeit*. The choices I made in my PhD project enabled me to evolve a methodology of navigating distinctions, including the distinction between theory and practice, in order to observe play through research and performative practice. It would be informative to see how further research into various phenomena of play like the ones discussed in chapter *Play vs. Non-Play* (p. 49) can be undertaken. I would also be interested to see how the requirements set up in section *Requirements for a New Paradigm* (p. 24) and the design directions envisioned in *Designing Playful Systems* (p. 156) can evolve through subsequent critique.

It is fair to assume that the exploration of Virtual and Augmented Realities will continue, hopefully not only under the conditions of economic interests from the entertainment and other industries, but also in a playful and artistic way. The key to this is the diversity of future creators, as I have discussed in chapter *Virtual vs. Real* (p. 73) and through my project *Imperfect VR* (see *Project: Imperfect VR* (p. 74)). Research into artificial intelligence and machine learning is developing at a breath-taking pace and the other disciplines humanities and sociology are catching up. I would assume that play will continue to act as a segue into the construction and observation of social systems between human and

machines as illustrated in chapter Human vs. Machine (p. 97). Understanding the world through ecological perspectives is the topic of chapter System vs. Environment (p. 123). With regard to designing playful systems, the notion of architecting around play rather than designing for play (see Architecting Environments (p. 126)) seems a promising avenue to me that needs further research and practice.

My contributions to knowledge that are summarised in section Contribution to Knowledge (p. 5) have now come back in a strange loop of theory and practice. I have been playing with distinctions from a general systems-theoretic perspective, created a bridge where theory and practice are informing each other and designed or re-contextualised and exposed my practice as research (see Mateas and Schwab: Artistic Research (p. 38)) in eight playful interactions. My requirements for a new paradigm (see Requirements for a New Paradigm (p. 24)) have become directions for designing playful systems (see Designing Playful Systems (p. 156)). By constructing a systems-theoretic approach as *research informed practice / practice informed research* reflected in chapter Theory vs. Practice (p. 149), I am contributing both to the studies of play and games and to the future practice of playful design. This thesis marks a foundation step towards this goal; Both theory and practice need to be developed further in future work. A lot remains to be done and played.

Now finally, I come to play with the thesis itself.

Meta-thetical Dialog

A: So how did this thesis come about?

B: I began to look at play, the phenomenon, and realised that there are so many theories about it! Everyone seems to have opinions, and there is so much conflict and contradiction. So I decided to take a step back to first clarify how I was going to look at play. This became chapter Distinction vs. Identity (p. 15).

A: And these “glasses” you are looking through are based on second-order cybernetics, radical constructivism, autopoiesis and social systems theory?

B: Yes and most fundamentally. . .

A: . . . on distinctions. What makes a distinction more fundamental than an identity?

B: Read the Bible, Genesis 1.

A: I am not that religious.

B: In a nutshell: God draws a lot of distinctions while creating everything. Ok, then. Let's say you want to express an identity, for example "A equals B".

A: This is what definitions do?

B: Similar. A definition says "an A is a B". However, both require that you first draw a distinction, namely between "A" and "B" so you can put the "=", "equals" or "is" between them. So definitions requires distinctions.

A: But according to Luhmann distinctions also are holding together their sides in some kind of identity?

B: They do. "Play vs. Work" says more than "Play" alone.

A: This sounds paradoxical to me. Also, some of this distinctive talk seems quite complicated. I tried to read Laws of Form.

B: Don't worry, you are not alone. We do not delve into the logical depths of it, yet we can observe play and playfulness in all their paradoxes and contradictions. Let's look at three pictures.

A: This thesis in three pictures?

B: If you want. Here is the first one. I found it in Oxford where I gave my first talk outside of Plymouth.

A: How Oxford-ish!

B: And here is the second one. I made it in Bristol during the Making the City Playable conference.



Figure 6.1: No Frisbee



A: How Bristolian!

B: And the third one you can make yourself. First take a strip of paper. Write on the front: "Research informs". Then turn it around, rotate by 180 degrees and write "Practice

informs”.

B: Wait, wait, not so fast. Informs what? They certainly must inform something?

A: You sound like a supervisor. Trust me.

B: (scribbles)

A: Now make a Moebius strip (see What Is Play? (p. 15), footnote) and read.

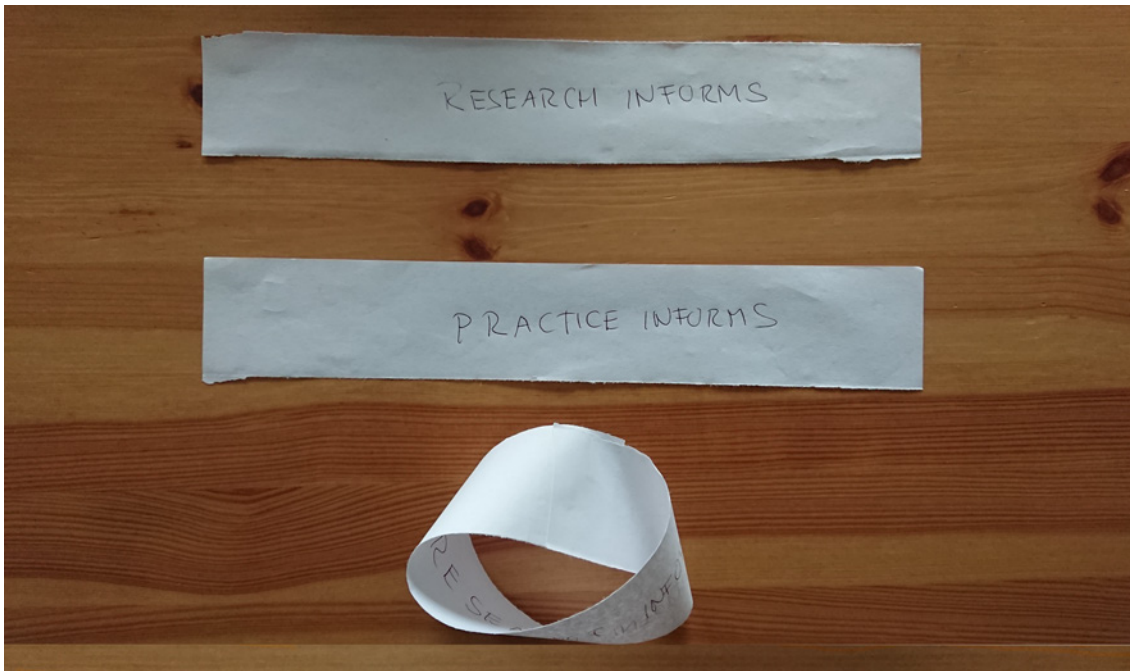


Figure 6.2: A Strange Loop

B: (reads out loud) “RESEARCH INFORMS PRACTICE INFORMS RESEARCH INFORMS...” Ah, I see.

A: A strange loop.

B: Indeed and you found this out by doing — research by practice.

A: This becomes almost ethical.

B: A meta-ethical dialog?

B: Let's stay with the meta-thetical dialog.

A: Yes, but I think von Foerster's ethical imperative (see What Is Play? (p. 15)) makes it an anti-reductionist thesis.

Q: Yes, but we need to make one reduction.

A: Go on.

Q: During our discussion I discovered that you are talking to yourself.

A: Am I? But then you must be doing the same, don't you?

B: I do. But doesn't that mean that you and me are the same person? A equals B?

A and B: This is necessarily so. They won't allow two people writing this thesis.

A and B: Then. . .

Back to Work

Between Schiller's romanticism, Huizinga's anthropocentrism and Bogost's pragmatism, a shared intent becomes manifest: to defend play against demands of a meritocratic society, prerogative of utility and accusations of frivolity.

As King Midas had to learn in the case of gold, (Ovidius Naso 2008), I caution about what we wish for play. Zimmerman's quote in the Introduction (p. 1) and some of the speculations discussed in section Counterpoint: Machines Play (p. 118) that suggest everything might become play appear to give an optimistic outlook. But is no work and all play the utopia we wish for?

For me, the now more than a decade-long pursuit of play came with a surprising twist. Everything I touched regarding play became work. My projects, the ones that I did and the ones that I did not include in this thesis certainly were work, where play appeared as a result rather than as a foundation. A playful attitude often was key to continue under difficult circumstances.

This is a vital realisation about play: you cannot do anything with it, except to play. Play resists objectification, even the well-meant ones. You play or you don't. Everything else is work. The kid in the psychology lab watched over by the scientist eager to extract new findings, the many students that are exposed to educational games, the scholars that studying play — they do not play. At least not in these moments. Therefore, we need space for play and for work.

That leaves a question: have I been working on my thesis or have I been playing with distinctions? Could it be both at the same time as long as no one asks? Fundamentally, the exploration of play has told me important things about the human condition. In my memory about the Cold War (p. 1), I have described how my quest to understand play is

rooted in my non-understanding of work. Now after some thorough research into play, I realise that I have made my peace with work. Maybe play now needs to rest for a while. A strange loop indeed.

Appendices

Appendix A

The Appendix is published in a separate ZIP file. It contains a brochure including photos, sketches and product credits for each of the practical projects, in the order they appear in the main text. For some of the projects, I included additional documentation.

01_HEFT/01_HostileEnvironmentFacilityTraining.pdf

01_HEFT/HEFT Concept.pdf

01_HEFT/HEFT Moods and Props.pdf

01_HEFT/HEFT Script.pdf

01_HEFT/heft_1.mp4

01_HEFT/heft_2.mp4

01_HEFT/heft_3.mp4

02_Spiel1/02_Spiel1.pdf

02_Spiel1/code.zip

03_ImperfectVR/03_ImperfectVR.pdf

03_ImperfectVR/imperfect-vr-master.zip

04_Neurotic/04_Neurotic.pdf

04_Neurotic/Mediacity5_Neurotic.pdf

04_Neurotic/code.zip

05_KlingKlangKlong/05_KlingKlangKlong.pdf

05_KlingKlangKlong/code.zip

06_CO2rnwallCO2Challenge/06_CO2rnwallCO2Challenge.pdf

06_CO2rnwallCO2Challenge/CO2rnwall Script.pdf

06_CO2rnwallCO2Challenge/CO2rnwall.mp4

06_CO2rnwallCO2Challenge/www.zip

07_PFIP/07_PedestrianFitnessInitiativeForPlymouth.pdf

07_PFIP/Mediacity5_Pedestrian_Fitness_Initiative_for_Plymouth.pdf

07_PFIP/Mediacity5_Pedestrian_Fitness_Initiative_for_Plymouth_Handout.pdf

07_PFIP/PFIP.mov

08_SpeedGardeningGuerrilla/08_SpeedGardeningGuerrilla.pdf

Bibliography

Artworks / Ludography

42 Entertainment (2004). *I Love Bees*.

A rose is (2001). *Brain Study*. URL: <http://www.roseis.de/eabout.htm> (visited on 05/28/2019).

Antoni, Janine (1994). *Slumber*. URL: <http://www.documenta14.de/en/artists/22238/janine-antoni> (visited on 05/28/2019).

Bach, Johann Sebastian (1747). *Musical Offering*.

Banksy (2015). *Dismaland*. URL: <http://www.dismaland.co.uk>.

Beuys, Joseph (1982). *7000 Oak Trees*. URL: <https://www.tate.org.uk/art/artworks/beuys-7000-oak-trees-ar00745> (visited on 10/23/2018).

Bigelow, Catherine (1995). *Strange Days*.

Blizzard Entertainment (1998). *Starcraft*. URL: <https://starcraft.com>.

— (2004). *World of Warcraft*. URL: <https://worldofwarcraft.com>.

Cattelan, Maurizio (1991). *Stadium*.

Colinart, Arnaud (2016). *Notes on Blindness: Into Darkness*.

Davis, Kevan (2009). *Paparazzi*. URL: <http://ludocity.org/wiki/Paparazzi> (visited on 06/21/2019).

Demers, Louis-Philippe and Bill Vorn (2015). *Inferno*. URL: <http://billvorn.concordia.ca/robography/inferno.html>.

Dumitriu, Anna (2018). *Plague Dress*. URL: <https://annadumitriu.tumblr.com/PlagueDress>.

Escher, M.C (1948). *Drawing Hands*.

Farbs (2008). *ROM CHECK FAIL*. URL: <http://www.farbs.org/romcheckfail.php>.

- Farocki, Harun (2009). *Serious Games III: Immersion*. URL: <https://www.harunfarocki.de/installations/2000s/2009/serious-games-iii-immersion.html>.
- (2010a). *Serious Games I: Watson Is Down*. URL: <https://www.harunfarocki.de/installationen/2010er/2010/ernste-spiele-i-watson-ist-hin.html>.
- (2010b). *Serious Games II: Three Dead*. URL: <https://www.harunfarocki.de/installations/2010s/2010/serious-games-ii-three-dead.html>.
- (2010c). *Serious Games IV: A Sun without Shadow*. URL: <https://www.harunfarocki.de/installations/2010s/2010/serious-games-iv-a-sun-without-shadow.html>.
- Fincher, David (1997). *The Game*. URL: <https://www.imdb.com/title/tt0119174/>.
- Gauntlett, Jane (2011). *In My Shoes*. URL: <https://web.archive.org/web/20170801163919/janegauntlett.com/inmyshoesproject> (visited on 08/01/2017).
- Grant, Jane, John Matthias, and Nick Ryan (2008a). *The Fragmented Orchestra*. URL: <http://www.thefragmentedorchestra.com/>.
- Haake, Hans (2010). *Ten Turtles Set Free*.
- Hertz, Garnet (2005). *Cockroach Controlled Mobile Robot V3*. URL: <http://conceptlab.com/roachbot/>.
- Höller, Carsten (2000). *Frisbee House*.
- Humbert, Jacqueline (1974). *Brainwave Etch a Sketch*. URL: <http://rhizome.org/editorial/2007/mar/12/j-humbert-brainwave-etch-a-sketch-1974/>.
- Hyphen Labs (2017). *NeuroSpeculative AfroFeminism*. URL: <http://www.hyphen-labs.com/nsaf.html>.
- Interactive Institute (2000). *Brainball*.
- Jodi (1996–2001). *Untitled Game*.
- Kac, Eduardo (2000). *GFP Bunny*.
- Kanary Nikolov(a), Jennifer (2016a). *Labyrinth Psychotica*. URL: <https://www.labyrinthpsychotica.org>.
- Key, Ed and David Kanaga (2013). *Proteus*.
- Kraftwerk (1972). *Kling Klang*.
- Lucier, Alvin (1965). *Music for Solo Performer*.
- machina Ex (2015). *Right of Passage*.
- Magritte, René (1929). *The Treachery of Images*.
- Marshmallow Laser Feast (2016). *In the Eyes of the Animal*.
- McCleary, Mikey (2014). *The World Is Our Playground*.

- Minter, Jeff (2007). *Space Giraffe*. URL: https://en.wikipedia.org/wiki/Space_Giraffe.
- Mojang (2011). *Minecraft*.
- Morozov, Dmitry (2018). *Umbilical Digital*. URL: <http://vtol.cc/filter/works/umbilical-digital>.
- Niantic (2016). *Pokémon Go*.
- Omsk Social Club (Jan. 2019a). *Athame*. URL: https://docs.google.com/document/d/1p6xPTa8gX32ojj61axAyABYgZeT_Rq0Z7IMrBAFSse8/mobilebasic.
- Ono, Yoko (1963). *Snow Piece (Tape Piece III)*.
- Ott, Daniel et al. (2015). *Phantom Synchron - Soundtrack Weimar*. URL: <http://sebastianquack.com/en/projects/phantom-synchron>.
- Pope, Lucas (2013). *Papers, Please*.
- Reiff, Tilman and Volker Morawe (2001). *Painstation*.
- Salter, Chris and TeZ (2016). *Haptic Field*. URL: <http://www.chrissalter.com/haptic-field/>.
- Schreiner, Julius-Christian (2018). *Silent Agents*. URL: <https://www.juliuscschreiner.com/silent-agents/> (visited on 05/26/2019).
- Smith, David and Frauke Zeller (2014). *hitchBOT*. URL: <http://www.hitchbot.me> (visited on 04/02/2015).
- Somethin' Else (2010). *Papa Sangre*.
- Speakman, Duncan, Sarah Anderson, and Emilie Grenier (2013). *A Folded Path*. URL: <http://wearecircumstance.com/a-folded-path/>.
- Straeubig, Michael (2008). *Tidy City*.
- (2011). *20000 Nanometers under the Sea*.
- (2012). *Speed Gardening Guerrilla*. URL: http://ludocity.org/wiki/Speed_Gardening_Guerrilla (visited on 06/20/2019).
- (2013a). *El Prado Gardening Guerilla*. URL: http://ludocity.org/wiki/Speed_Gardening_Guerrilla (visited on 06/20/2019).
- (2013c). *Spiel 1*.
- (2014b). *CO2rwall CO2 Challenge*.
- (2014c). *KlingKlangKlong*.
- (2014d). *Neurotic*.
- (2015d). *Pedestrian Fitness Initiative for Plymouth*.

- Straeubig, Michael (2016e). *Imperfect VR*. URL: <https://github.com/i3games/imperfect-vr>.
- (2018a). *Hostile Environment Facility Training*. URL: <https://www.furtherfield.org/playbour-work-pleasure-survival/>.
- Straschnoy, Axel et al. (2008). *The New Artist*. URL: <http://www.the-new-artist.info/>.
- Tinguely, Jean (1978). *Méta-Harmonie II*.
- Ubisoft (2002). *America's Army*. URL: <https://www.americasarmy.com>.
- Uribe, Federico (2019). *Plastic Reef*.
- Vermeulen, Angelo (2007). *Biomodd*. URL: <http://www.biomodd.net/>.
- Warren, Sophie and Jonathan Mosley (2006). *Platform*. URL: <http://warrenandmosley.com/category/all-works/>.
- (2012). *Rogue Game, First Play*. URL: <http://warrenandmosley.com/category/all-works/>.
- Wee, Jason (2017). *Labyrinths*.
- Zamboni, Julia (2017). *Robot Ludens*. URL: <https://zkm.de/en/media/video/julia-zamboni-robot-ludens-2017> (visited on 06/22/2019).

References

- A Guide to the Hostile Environment* (Apr. 2018). National Council for Civil Liberties.
- Aarseth, Espen (2012). "A Narrative Theory of Games". In: *Proceedings of the International Conference on the Foundations of Digital Games - FDG '12*. The International Conference. Raleigh, North Carolina: ACM Press, p. 129. ISBN: 978-1-4503-1333-9. DOI: 10.1145/2282338.2282365. URL: <http://dl.acm.org/citation.cfm?doid=2282338.2282365> (visited on 08/07/2019).
- Aarseth, Espen J. (1997). *Cybertext: Perspectives on Ergodic Literature*. Baltimore, Md: Johns Hopkins University Press. ISBN: 0-8018-5578-0.
- (July 2001). "Computer Game Studies, Year One". In: *the international journal of computer game research* 1.1. URL: <http://www.gamestudies.org/0101/editorial.html> (visited on 07/25/2019).
- (May 19, 2016). "Ludemes, Ludo-Hermeneutics and the Autonomy-Aesthetics of Gameplay". International Symposium on Electronic Art (Hong Kong).

- Abovitz, Rony (Feb. 23, 2019). *What Is The Magicverse (And Why)?* URL: <https://www.magicleap.com/stories/blog/magicverse> (visited on 02/26/2019).
- Ackermann, Edith (2001). "Piaget's Constructivism, Papert's Constructionism: What's the Difference". In: *Future of learning group publication* 5.3, p. 438. URL: <http://www.sylvia stipich.com/wp-content/uploads/2015/04/Coursera-Piaget--Papert.pdf> (visited on 01/27/2017).
- Alexander, Leigh (Aug. 28, 2014). *'Gamers' Don't Have to Be Your Audience. 'Gamers' Are Over.* URL: https://www.gamasutra.com/view/news/224400/Gamers_dont_have_to_be_your_audience_Gamers_are_over.php (visited on 03/05/2019).
- Alley, Richard et al. (2007). *Climate Change 2007: The Physical Science Basis*. Paris: Intergovernmental Panel on Climate Change.
- Anchor, Robert (Feb. 1978). "History and Play: Johan Huizinga and His Critics". In: *History and Theory* 17.1, p. 63. ISSN: 00182656. DOI: 10.2307/2504901. URL: <https://www.jstor.org/stable/2504901?origin=crossref> (visited on 09/14/2019).
- Andersen, Niels (2009). *Power at Play: The Relationships between Play, Work, and Governance*. Basingstoke ; New York: Palgrave Macmillan. ISBN: 978-0-230-22820-7.
- Anderson, Craig A. and Karen E. Dill (2000). "Video Games and Aggressive Thoughts, Feelings, and Behavior in the Laboratory and in Life." In: *Journal of Personality and Social Psychology* 78.4, pp. 772–790. ISSN: 1939-1315, 0022-3514. DOI: 10.1037/0022-3514.78.4.772. URL: <http://doi.apa.org/getdoi.cfm?doi=10.1037/0022-3514.78.4.772> (visited on 03/04/2019).
- Ansell-Pearson, Keith (2005). "The Reality of the Virtual: Bergson and Deleuze". In: *MLN* 120.5, pp. 1112–1127. ISSN: 1080-6598. DOI: 10.1353/mln.2006.0020. URL: <http://muse.jhu.edu/content/crossref/journals/mln/v120/120.5pearson.html> (visited on 09/17/2019).
- Antonello, Pierpaolo (Jan. 1, 2009). "Beyond Futurism: Bruno Munari's Useless Machines". In: *Futurism and the Technological Imagination*. Ed. by Günter Berghaus. Brill | Rodopi, pp. 315–336. DOI: 10.1163/9789042027480_014. URL: <https://brill.com/view/book/edcoll/9789042027480/B9789042027480-s014.xml> (visited on 09/25/2019).
- Archer, Dan and Katharina Finger (Mar. 15, 2018). *Walking in Another's Virtual Shoes: Do 360-Degree Video News Stories Generate Empathy in Viewers?* New York: Tow Center for Digital Journalism, Columbia University. URL: https://www.cjr.org/tow_center_reports/virtual-reality-news-empathy.php/ (visited on 02/25/2019).

- Arendt, Hannah (1998). *The Human Condition*. 2nd ed. Chicago: University of Chicago Press.
- Aristotle (1998). *Metaphysics*. Penguin Classics. London ; New York: Penguin Books [–349]. ISBN: 978-0-14-044619-7.
- Arjoranta, Jonne (May 29, 2019). “How to Define Games and Why We Need To”. In: *The Computer Games Journal*. ISSN: 2052-773X. DOI: 10.1007/s40869-019-00080-6. URL: <http://link.springer.com/10.1007/s40869-019-00080-6> (visited on 06/12/2019).
- Arjoranta, Jonne and Veli-Matti Karhulahti (2014). “Ludology, Narratology and Philosophical Hermeneutics”. In: *Proceedings of Nordic DiGRA 2014. Digital Games Research Association*. URL: <https://jyx.jyu.fi/dspace/handle/123456789/43943> (visited on 02/03/2017).
- Arnold, Darrell, ed. (2014). *Traditions of Systems Theory: Major Figures and Contemporary Developments*. Routledge Studies in Library and Information Science 11. 02. New York ; London: Routledge. ISBN: 978-0-415-84389-8.
- Arora, Sanjeev (2009). *Computational Complexity: A Modern Approach*. In collab. with Boaz Barak. Cambridge ; New York: Cambridge University Press. ISBN: 978-0-521-42426-4.
- Asch, S. E. (1951). “Effects of Group Pressure upon the Modification and Distortion of Judgments.” In: *Groups, Leadership and Men; Research in Human Relations*. Oxford, England: Carnegie Press, pp. 177–190.
- Ashby, W. Ross (1956). *An Introduction to Cybernetics*. Eastford: Martino Fine Books [1956]. ISBN: 978-1-61427-765-1.
- Assuncao, Carina (June 18, 2018). “Is Pokémon GO Feminist? An Actor-Network Theory Analysis”. In: *Transactions of the Digital Games Research Association* 3.3. ISSN: 2328-9422, 2328-9414. DOI: 10.26503/todigra.v3i3.78. URL: <http://todigra.org/index.php/todigra/article/view/78> (visited on 08/28/2019).
- Audi, Robert (2002). *Epistemology a Contemporary Introduction*. OCLC: 437154173. Hoboken: Taylor & Francis Ltd.
- Ayer, A. J (1959). *Logical Positivism*. OCLC: 31594510. New York: Free Press. ISBN: 978-0-02-901130-0.
- Badham, John, director (1983). *WarGames*. URL: <https://www.imdb.com/title/tt0086567/>.

Baecker, Dirk (2013a). *Form und Formen der Kommunikation*. 3. Aufl. Suhrkamp-Taschenbuch Wissenschaft 1828. OCLC: 903261187. Frankfurt am Main: Suhrkamp. ISBN: 978-3-518-29428-4.

— (Jan. 18, 2013b). "Systemic Theories of Communication". In: *Theories and Models of Communication*. Ed. by Paul Cobley and Peter J. Schulz. Berlin, Boston: De Gruyter, pp. 85–100. ISBN: 978-3-11-024045-0. DOI: 10.1515/9783110240450.85. URL: <https://www.degruyter.com/view/books/9783110240450/9783110240450.85/9783110240450.85.xml> (visited on 04/07/2019).

Baltezarevic, Radoslav et al. (2019). "The Impact of Virtual Communities on Cultural Identity". In: *Symposion* 6.1, pp. 7–22. ISSN: 1584-174X. DOI: 10.5840/symposion2019611. URL: http://www.pdcnet.org/oom/service?url_ver=Z39.88-2004&rft_val_fmt=&rft.imuse_id=symposion_2019_0006_0001_0007_0022&svc_id=info:www.pdcnet.org/collection (visited on 08/13/2019).

Banaschewski, Bernhard (1977). "On G. Spencer-Brown's Laws of Form". In: *Notre Dame Journal of Formal Logic* 18, pp. 507–509.

Bar-Yam, Yaneer (1997). *Dynamics of Complex Systems*. Vol. 213. Addison-Wesley Reading, MA.

Baraldi, Claudio, Giancarlo Corsi, and Elena Esposito (1997). *GLU: Glossar Zu Niklas Luhmanns Theorie Sozialer Systeme*. 1. Aufl. Suhrkamp Taschenbuch Wissenschaft 1226. Frankfurt am Main: Suhrkamp. ISBN: 978-3-518-28826-9.

Barrett, Estelle and Barbara Bolt (2010). *Practice as Research Approaches to Creative Arts Enquiry*. I.B.Tauris. URL: <http://site.ebrary.com/id/10209724> (visited on 09/09/2014).

Bartle, Richard A. (2004). *Designing Virtual Worlds*. Indianapolis, Ind: New Riders Pub. ISBN: 978-0-13-101816-7.

Bateson, Gregory (2000a). "Form, Substance and Difference". In: *Steps to an Ecology of Mind*. University of Chicago Press ed. Chicago: University of Chicago Press, pp. 454–471.

— (2000b). *Steps to an Ecology of Mind*. University of Chicago Press ed. Chicago: University of Chicago Press.

Bateson, Gregory and Mary Catherine Bateson (2005). *Angels Fear: Towards an Epistemology of the Sacred*. Advances in Systems Theory, Complexity and the Human Sciences. OCLC: 835014503. Cresskill, N.J: Hampton. ISBN: 978-1-57273-594-1.

- Bateson, Patrick (Jan. 2015). "Playfulness and Creativity". In: *Current Biology* 25.1, R12–R16. ISSN: 09609822. DOI: 10.1016/j.cub.2014.09.009. URL: <http://linkinghub.elsevier.com/retrieve/pii/S0960982214011245> (visited on 01/11/2015).
- Bateson, Patrick and Kevin N. Laland (Dec. 2013). "Tinbergen's Four Questions: An Appreciation and an Update". In: *Trends in Ecology & Evolution* 28.12, pp. 712–718. ISSN: 01695347. DOI: 10.1016/j.tree.2013.09.013. URL: <http://linkinghub.elsevier.com/retrieve/pii/S016953471300236X> (visited on 08/31/2015).
- Bateson, Patrick and Paul Martin (2013). *Play, Playfulness, Creativity and Innovation*. Cambridge: Cambridge University Press.
- Baudrillard, Jean (1994). *Simulacra and Simulation*. The Body, in Theory. Ann Arbor: University of Michigan Press.
- Bean, Anthony M. et al. (Oct. 2017). "Video Game Addiction: The Push to Pathologize Video Games." In: *Professional Psychology: Research and Practice* 48.5, pp. 378–389. ISSN: 1939-1323, 0735-7028. DOI: 10.1037/pro0000150. URL: <http://doi.apa.org/getdoi.cfm?doi=10.1037/pro0000150> (visited on 03/04/2019).
- Beer, Randall D. (2004). "Autopoiesis and Cognition in the Game of Life". In: *Artificial Life* 10.3, pp. 309–326. URL: <http://www.mitpressjournals.org/doi/abs/10.1162/1064546041255539> (visited on 02/04/2017).
- Bekoff, Marc, ed. (1998). *Animal Play: Evolutionary, Comparative, and Ecological Perspectives*. 1. pub. OCLC: 832750523. Cambridge: Cambridge Univ. Press.
- Berger, John (2008). *Ways of Seeing*. Penguin on Design. OCLC: 836938276. London: British Broadcasting Corporation and Penguin Books. ISBN: 978-0-14-103579-6.
- Berger, Peter L. and Thomas Luckmann (1990). *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. New York: Anchor Books. ISBN: 978-0-385-05898-8.
- Bergonse, Rafaello (Dec. 2017). "Fifty Years on, What Exactly Is a Videogame? An Essentialistic Definitional Approach". In: *The Computer Games Journal* 6.4, pp. 239–255. ISSN: 2052-773X. DOI: 10.1007/s40869-017-0045-4. URL: <http://link.springer.com/10.1007/s40869-017-0045-4> (visited on 06/12/2019).
- Bergson, Henri (2007). *Matter and Memory*. New York: Cosimo.
- Berlyne, E.D. (1960). *Conflict, Arousal, and Curiosity*. Vol. xii. McGraw-Hill Series in Psychology. New York, NY, US: McGraw-Hill Book Company.

- Bernstein, Lenny et al. (2007). *Climate Change 2007: Synthesis Report*. Valencia, Spain: Intergovernmental Panel on Climate Change.
- Berry, Ian and Rube Goldberg (2001). *Chain Reaction: Rube Goldberg and Contemporary Art*. In collab. with Williams College and Frances Young Tang Teaching Museum and Art Gallery. OCLC: ocm50255865. Williamstown, MA : Saratoga, NY: Williams College Museum of Art ; Tang Teaching Museum and Art Gallery at Skidmore College. ISBN: 978-0-9708790-0-4.
- Bertalanffy, Ludwig von (1950). "An Outline of General System Theory". In: *The British Journal for the Philosophy of Science* I.2, pp. 134–165. ISSN: 0007-0882, 1464-3537. DOI: 10.1093/bjps/I.2.134. URL: <https://academic.oup.com/bjps/article-lookup/doi/10.1093/bjps/I.2.134> (visited on 07/04/2019).
- (1968). *General System Theory: Foundations, Development, Applications*. 04. New York: George Braziller, Inc. ISBN: 978-0-8076-0015-3.
- Bertrand, Philippe (2019). *BeAnotherLab*. URL: <http://beanotherlab.org/> (visited on 09/03/2019).
- Bertrand, Philippe et al. (2014). "'The Machine to Be Another': Embodiment Performance to Promote Empathy among Individuals". In: *AISB 2014 - 50th Annual Convention of the AISB*, p. 5.
- Bichlbaum, Andy and Mike Bonanno, director (2009). *The Yes Men Fix The World*. URL: <https://www.imdb.com/title/tt1352852/>.
- Bishop, Claire (2012). *Artificial Hells: Participatory Art and the Politics of Spectatorship*. London ; New York: Verso Books. ISBN: 978-1-84467-690-3.
- Bishop, J Mark and Mohammad M Al-Rifaie (2016a). "Autopoiesis, Creativity and Dance". In: p. 15.
- Bishop, Mark and Mohammad Majid Al-Rifaie (2016b). "Autopoiesis in Creativity and Art". In: 03. ACM Press, pp. 1–6. ISBN: 978-1-4503-4307-7. DOI: 10.1145/2948910.2948948. URL: <http://dl.acm.org/citation.cfm?doid=2948910.2948948> (visited on 02/04/2017).
- Blassnigg, Martha and Michael Punt (2013). *Transdisciplinarity: Challenges, Approaches and Opportunities at the Cusp of History*. Plymouth University.
- Bloom, Paul (2016). *Against Empathy: The Case for Rational Compassion*. First edition. OCLC: ocn964448730. New York, NY: Ecco, an imprint of HarperCollins Publishers. ISBN: 978-0-06-233933-1.

- Bloom, Paul (Jan. 2017). "Empathy and Its Discontents". In: *Trends in Cognitive Sciences* 21.1, pp. 24–31. ISSN: 13646613. DOI: 10.1016/j.tics.2016.11.004. URL: <https://linkinghub.elsevier.com/retrieve/pii/S1364661316301930> (visited on 02/25/2019).
- Bogost, Ian (2006). *Unit Operations: An Approach to Videogame Criticism*. OCLC: ocm62110050. Cambridge, Mass: MIT Press. ISBN: 978-0-262-02599-7.
- (2010). *Persuasive Games: The Expressive Power of Videogames*. 1. MIT Press paperback ed., [Nachdr.] OCLC: 767937610. Cambridge, Mass.: MIT Press. ISBN: 978-0-262-51488-0.
- (2011). *Gamification Is Bullshit*. URL: http://bogost.com/writing/blog/gamification_is_bullshit/ (visited on 04/20/2016).
- (2012). *Alien Phenomenology, or, What It's like to Be a Thing*. Posthumanities 20. Minneapolis: University of Minnesota Press.
- Bonchev, Danail and D. H. Rouvray, eds. (2005). *Complexity in Chemistry, Biology, and Ecology*. Mathematical and Computational Chemistry. New York, NY: Springer. ISBN: 978-0-387-23264-5.
- Bond, Rod and Peter B. Smith (1996). "Culture and Conformity: A Meta-Analysis of Studies Using Asch's (1952b, 1956) Line Judgment Task". In: *Psychological Bulletin* 119.1, pp. 111–137.
- Borck, Cornelius (2018). *Brainwaves: A Cultural History of Electroencephalography*. OCLC: 1027574346. Routledge.
- Brockman, John (1996). *Third Culture: Beyond the Scientific Revolution*. OCLC: 777318712. London, UK: Touchstone : Simon & Schuster (Trade Division). ISBN: 978-0-684-82344-7.
- Bühler, Karl (Apr. 27, 2011). *Theory of Language: The Representational Function of Language*. Amsterdam: John Benjamins Publishing Company [1934]. URL: <http://www.jbe-platform.com/content/books/9789027286864> (visited on 03/15/2019).
- Burger, C. (July 1, 1985). "The Reality of "Machines," Notes on the Rhizome-Thinking of Deleuze and Guattari". In: *Telos* 1985.64, pp. 33–44. ISSN: 0090-6514, 1940-459X. DOI: 10.3817/0685064033. URL: <http://journal.telospress.com/cgi/doi/10.3817/0685064033> (visited on 07/28/2019).

- Burghardt, Gordon M. (2005a). "Play: Many Meanings, Few Answers". In: *The Genesis of Animal Play: Testing the Limits*. Cambridge, Mass.: MIT Press, pp. 1–20. ISBN: 978-0-262-02543-0.
- (2005b). *The Genesis of Animal Play: Testing the Limits*. Cambridge, Mass.: MIT Press. ISBN: 978-0-262-02543-0.
- (Dec. 22, 2010). *Defining and Recognizing Play*. Oxford University Press. DOI: 10.1093/oxfordhb/9780195393002.013.0002. URL: <http://oxfordhandbooks.com/view/10.1093/oxfordhb/9780195393002.001.0001/oxfordhb-9780195393002-e-002> (visited on 06/12/2019).
- (Jan. 2015). "Play in Fishes, Frogs and Reptiles". In: *Current Biology* 25.1, R9–R10. ISSN: 09609822. DOI: 10.1016/j.cub.2014.10.027. URL: <http://linkinghub.elsevier.com/retrieve/pii/S0960982214013335> (visited on 01/11/2015).
- Burkhalter, Gabrielle et al. (2016). *The Playground Project*. 1. Aufl. OCLC: 922713106. Zürich: JRP Ringier Kunstverlag. ISBN: 978-3-03764-454-6.
- Byrne, D. S. (2014). *Complexity Theory and the Social Sciences: The State of the Art*. First Edition. New York: Routledge, Taylor & Francis Group. ISBN: 978-0-415-69367-7.
- Caballero, Lorena, Bob Hodge, and Sergio Hernandez (June 14, 2016). "Conway's "Game of Life" and the Epigenetic Principle". In: *Frontiers in Cellular and Infection Microbiology* 6. ISSN: 2235-2988. DOI: 10.3389/fcimb.2016.00057. URL: <http://journal.frontiersin.org/Article/10.3389/fcimb.2016.00057/abstract> (visited on 09/05/2019).
- Cagnoni, Stefano, Marco Mirolli, and Marco Villani (2013). *Evolution, Complexity and Artificial Life*. Dordrecht: Springer. URL: <http://public.eblib.com/EBLPublic/PublicView.do?ptiID=1636585> (visited on 09/06/2014).
- Caillois, Roger (1961). *Man, Play, and Games*. Urbana: University of Illinois Press. ISBN: 0-252-07033-X.
- Carbo-Mascarell, Rosa (2016). "Walking Simulators: The Digitisation of an Aesthetic Practice". In: *Proceedings of 1st International Joint Conference of DiGRA and FDG*. Dublin, p. 15.
- Carse, James P. (1987). *Finite and Infinite Games*. New York: Ballantine Books.
- Catlow, Ruth, Marc Garrett, and Corrado Morgana (2010). *Artists Re:Thinking Games*. Liverpool: FACT (Foundation for Art and Creative Technology): Distributed by Liverpool University Press.

- Cawston, Barry, Tristan Manco, and Kath Cockshaw (2016). *Are We There yet?: A Day Trip to Banksy's Dismaland and Other Stories*. OCLC: 984127971.
- Chalmers, David John (1995). "Facing up to the Problem of Consciousness". In: *Journal of consciousness studies* 2.3, pp. 200–219. URL: <http://www.ingentaconnect.com/content/imp/jcs/1995/00000002/00000003/653> (visited on 09/11/2015).
- (Nov. 27, 2017). "The Virtual and the Real". In: *Disputatio* 9.46, pp. 309–352. ISSN: 0873-626X. DOI: 10.1515/disp-2017-0009. URL: <http://content.sciendo.com/view/journals/disp/9/46/article-p309.xml> (visited on 09/01/2019).
- Chang, Ha-joon (2011). *23 Things They Don't Tell You about Capitalism*. OCLC: 812258218. London New York Toronto: Penguin Books. ISBN: 978-0-14-104797-3.
- Chen, Jenova (2007). "Flow in Games (and Everything Else)". In: *Communications of the ACM* 50.4, pp. 31–34. URL: <http://dl.acm.org/citation.cfm?id=1232769> (visited on 02/22/2016).
- Cline, Ernest (2016). *Ready Player One*. OCLC: 940623243. Random House UK. ISBN: 978-0-09-956043-2.
- Collins Staff (2011). *Holy Bible: King James Version*. Collins.
- Cologne Game Lab (2011). *Notgames Fest*. URL: <http://notgames.colognegamelab.com/> (visited on 09/24/2019).
- Colville-Andersen, Mikael (Sept. 11, 2014). *Copenhagenize.Com - Bicycle Culture by Design: The Arrogance of Space - Paris, Calgary, Tokyo*. URL: <http://www.copenhagenize.com/2014/09/the-arrogance-of-space-paris-calgary.html> (visited on 01/25/2015).
- Comaroff, Jason (Win. 2017). "Defensive Architecture". In: *ArtReview Asia*. URL: https://artreview.com/opinion/ara_winter_2017_opinion_joshua_comaroff/ (visited on 05/26/2019).
- Consalvo, M. (Oct. 1, 2009). "There Is No Magic Circle". In: *Games and Culture* 4.4, pp. 408–417. ISSN: 1555-4120. DOI: 10.1177/1555412009343575. URL: <http://gac.sagepub.com/cgi/doi/10.1177/1555412009343575> (visited on 09/09/2014).
- Cook, Deborah, ed. (2008). *Theodor Adorno: Key Concepts*. Key Concepts. OCLC: 255273659. Stocksfield: Acumen.
- Costikyan, Greg (2015). *Uncertainty in Games*. OCLC: 985731249. Cambridge, Mass.1: MIT Press. ISBN: 978-0-262-52753-8. URL: <https://mitpress.mit.edu/books/uncertainty-games>.

- Creative Commons (2019). *Creative Commons — Attribution-NonCommercial 3.0 Unported — CC BY-NC 3.0*. URL: <https://creativecommons.org/licenses/by-nc/3.0/> (visited on 06/21/2019).
- Crosby, Matthew, Benjamin Beyret, and Marta Halina (May 2019). "The Animal-AI Olympics". In: *Nature Machine Intelligence* 1.5, pp. 257–257. ISSN: 2522-5839. DOI: 10.1038/s42256-019-0050-3. URL: <http://www.nature.com/articles/s42256-019-0050-3> (visited on 09/25/2019).
- Csikszentmihalyi, M. and J. Nakamura (2009). "Flow Theory and Research". In: *Handbook of Positive Psychology*. Ed. by C. R. Snyder and Shane J. Lopez. Oxford [England]; New York: Oxford University Press, pp. 195–206. ISBN: 978-0-19-803094-2.
- Csikszentmihalyi, Mihaly (1991). *Flow: The Psychology of Optimal Experience*. Harper Perennial.
- (1997). *Finding Flow: The Psychology of Engagement with Everyday Life*. 1st ed. MasterMinds. OCLC: 36315862. New York, NY: Basic Books.
- Cull, Paul and William Frank (Jan. 1979). "Flaws of Form". In: *International Journal of General Systems* 5.4, pp. 201–211. ISSN: 0308-1079, 1563-5104. DOI: 10.1080/03081077908547450. URL: <http://www.tandfonline.com/doi/abs/10.1080/03081077908547450> (visited on 03/14/2018).
- Davis, Heather and Etienne Turpin (2015). *Art in the Anthropocene: Encounters Among Aesthetics, Politics, Environments and Epistemologies*. Open Humanities Press. ISBN: 978-1-78542-005-4. DOI: 10.26530/OAPEN_560010. URL: <https://www.oapen.org/record/560010> (visited on 06/25/2019).
- DeKoven, Bernard (2013). *The Well-Played Game: A Player's Philosophy*. Cambridge, Massachusetts: The MIT Press. ISBN: 978-0-262-01917-0.
- (2014). *A Playful Path*. ETC Press.
- Deleuze, Gilles (1994). *Difference and Repetition*. Repr. with corr. Continuum Impacts Changing Minds. OCLC: 838917761. London: Continuum. ISBN: 978-0-8264-7715-6.
- Deleuze, Gilles and Félix Guattari (1987). *A Thousand Plateaus: Capitalism and Schizophrenia*. Minneapolis: University of Minnesota Press.
- Denson, Shane and Julia Leyda (2016). *Post-Cinema: Theorizing 21st-Century Film*. OCLC: 946726424. ISBN: 978-0-9931996-2-2. URL: <http://reframe.sussex.ac.uk/post-cinema/> (visited on 09/03/2019).

- Derrida, Jacques (1973). "Differance". In: *Speech and Phenomena: And Other Essays on Husserl's Theory of Signs*. Evanston: Northwestern University Press, pp. 129–160.
- Dery, Mark, ed. (1994). *Flame Wars: The Discourse of Cyberculture*. Durham, NC: Duke University Press.
- Descartes, René (1972). *Treatise of man*. Harvard monographs in the history of science. Cambridge: Harvard University Press [1622]. ISBN: 978-0-674-90710-2.
- (1998). *Discourse on Method and Meditations on First Philosophy*. 4th ed. Indianapolis: Hackett Pub [1637].
- Deterding, S. (Sept. 1, 2016). "The Pyrrhic Victory of Game Studies: Assessing the Past, Present, and Future of Interdisciplinary Game Research". In: *Games and Culture*. ISSN: 1555-4120, 1555-4139. DOI: 10.1177/1555412016665067. URL: <http://gac.sagepub.com/cgi/doi/10.1177/1555412016665067> (visited on 10/18/2016).
- Deterding, Sebastian et al. (2011). "Gamification: Using Game-Design Elements in Non-Gaming Contexts". In: *CHI'11 Extended Abstracts on Human Factors in Computing Systems*. ACM, pp. 2425–2428. URL: <http://dl.acm.org/citation.cfm?id=1979575> (visited on 09/07/2014).
- Diderot, Denis (1994). *Selected Writings on Art and Literature*. Penguin Classics. London ; New York: Penguin Books. ISBN: 978-0-14-044588-6.
- Dombeck, Daniel A. and Michael B. Reiser (Feb. 2012). "Real Neuroscience in Virtual Worlds". In: *Current Opinion in Neurobiology* 22.1, pp. 3–10. ISSN: 09594388. DOI: 10.1016/j.conb.2011.10.015. URL: <https://linkinghub.elsevier.com/retrieve/pii/S0959438811001814> (visited on 02/23/2019).
- Dörner, Ralf et al. (2018). *Serious Games Foundations, Concepts and Practice*. OCLC: 1049591750. ISBN: 978-3-319-82137-5.
- Dumitriu, Anna and Bobbie Farsides (2014). *Trust Me, I'm an Artist: Towards an Ethics of Art and Science Collaboration*. OCLC: 953603753. URL: <https://artscienceethics.tumblr.com>.
- Dunne, Anthony and Fiona Raby (2013). *Speculative Everything: Design, Fiction, and Social Dreaming*. The MIT Press. ISBN: 978-0-262-01984-2.
- Durand, Cédric (2017). *Fictitious Capital: How Finance Is Appropriating Our Future*. OCLC: 982214314. London: Verso.
- Eberle, Scott G (2014). "Toward a Philosophy and a Definition of Play". In: *American Journal of Play* 6.2, p. 20.

- Ebert, Roger (July 1, 2010a). *Okay, Kids, Play on My Lawn*. URL: <https://www.rogerebert.com/rogers-journal/okay-kids-play-on-my-lawn> (visited on 06/02/2014).
- (Apr. 16, 2010b). *Video Games Can Never Be Art*. URL: <https://www.rogerebert.com/rogers-journal/video-games-can-never-be-art> (visited on 06/02/2014).
- Eisen, George (Jan. 11, 1990). *Children and Play in the Holocaust: Games among the Shadows*. Amherst: University of Massachusetts Press. ISBN: 978-0-87023-708-9.
- Eliasmith, Chris (2013). *How to Build a Brain: A Neural Architecture for Biological Cognition*. Oxford Series on Cognitive Models and Architectures. OCLC: 855538573. Oxford University Press.
- Elkins, James (1997). *The Object Stares Back: On the Nature of Seeing*. 1st Harvest ed. A Harvest Book. San Diego: Harcourt Brace. ISBN: 978-0-15-600497-8.
- Elledge, John (Nov. 17, 2014). *In Pictures: Do Cars Take up Too Much Space on City Streets?* URL: <http://www.citymetric.com/transport/pictures-do-cars-take-too-much-space-city-streets-483> (visited on 01/25/2015).
- Ellin, Nan and Edward J. Blakely, eds. (1997). *Architecture of Fear*. 1st ed. New York: Princeton Architectural Press. ISBN: 978-1-56898-082-9.
- Ellis, Carolyn, Tony E. Adams, and Arthur P. Bochner (2011). "Autoethnography: An Overview". In: *Historical Social Research/Historische Sozialforschung*, pp. 273–290. JSTOR: 23032294.
- Ellis, Michael J. (1973). *Why People Play*. Englewood Cliffs, N.J: Prentice-Hall. ISBN: 0-13-958991-0.
- Erikson, Erik H. (1993). *Childhood and Society*. New York: Norton. ISBN: 0-393-31068-X.
- Escalona, Sybille (1943). "Play and Substitute Satisfaction". In: *Child Behavior and Development: A Course of Representative Studies*. Ed. by R. G. Barker, J. S. Kounin, and H. F. Wright. New York, NY, US: McGraw-Hill, pp. 363–378.
- Eskelinen, Markku (July 2001). "The Gaming Situation". In: *the international journal of computer game research* 1.1. URL: <http://www.gamestudies.org/0101/eskelinen/> (visited on 08/07/2019).
- Espinosa, Julio García (1979). "For an Imperfect Cinema". Trans. by Julianne Burton. In: *Jump Cut: A Review of Contemporary Media* 20, pp. 24–26.
- Evans, Mel (2015). *Artwash: Big Oil and the Arts*. OCLC: 892455149.
- Felzmann, Sebastian (2010). "Playing Yesterday: Mediennostalgie und Videospiele". In: *Techniknostalgie und Retrotechnologie*. Ed. by Andreas Böhn. Karlsruher Studien

Technik und Kultur Bd. 2. OCLC: 680655565. Karlsruhe: KIT Scientific Publ, pp. 197–215. ISBN: 978-3-86644-474-4.

Ferguson, Christopher J. (Sept. 2015). "Do Angry Birds Make for Angry Children? A Meta-Analysis of Video Game Influences on Children's and Adolescents' Aggression, Mental Health, Prosocial Behavior, and Academic Performance". In: *Perspectives on Psychological Science* 10.5, pp. 646–666. ISSN: 1745-6916, 1745-6924. DOI: 10.1177/1745691615592234. URL: <http://journals.sagepub.com/doi/10.1177/1745691615592234> (visited on 03/04/2019).

Feyerabend, Paul (2010). *Against Method*. 4th ed. London ; New York: Verso. ISBN: 978-1-84467-442-8.

Feynman, Richard P. and Paul Davies (2011). *Six Easy Pieces: Essentials of Physics Explained by Its Most Brilliant Teacher*. In collab. with Robert B. Leighton and Matthew Sands. OCLC: 930760514. New York: Basic Books.

Fizek, Sonia (2016). *All Work and No Play*. URL: <http://www.firstpersonsolar.com/all-work-and-no-play/> (visited on 10/25/2016).

— (June 18, 2018). "Interpassivity and the Joy of Delegated Play in Idle Games". In: *Transactions of the Digital Games Research Association* 3.3. ISSN: 2328-9422, 2328-9414. DOI: 10.26503/todigra.v3i3.81. URL: <http://todigra.org/index.php/todigra/article/view/81> (visited on 03/05/2019).

Flanagan, Mary (2013). *Critical Play: Radical Game Design*. OCLC: 935016500. Cambridge, Mass. London: MIT Press. ISBN: 978-0-262-51865-9.

Floridi, Luciano (2009). "Against Digital Ontology". In: *Synthese* 168.1, pp. 151–178.

Fluegelman, Andrew, ed. (1976). *The New Games Book*. Garden City, N.Y: Dolphin Books. ISBN: 978-0-385-12516-1.

Fodor, Jerry Alan (1975). *The Language of Thought*. The Language and Thought Series. New York: Crowell.

Font, Jose M. and Tobias Mahlmann (Sept. 2019). "Dota 2 Bot Competition". In: *IEEE Transactions on Games* 11.3, pp. 285–289. ISSN: 2475-1502, 2475-1510. DOI: 10.1109/TG.2018.2834566. URL: <https://ieeexplore.ieee.org/document/8356682/> (visited on 09/25/2019).

Foot, Philippa (Oct. 17, 2002). *Virtues and Vices*. Oxford University Press. ISBN: 978-0-19-925286-2. DOI: 10.1093/0199252866.001.0001. URL: <http://www.oxfordscholarship>.

com/view/10.1093/0199252866.001.0001/acprof-9780199252862 (visited on 02/26/2019).

Foucault, Michel (1980). *Power/knowledge: selected interviews and other writings, 1972-1977*. 1st American ed. New York: Pantheon Books.

— (1995). *Discipline and Punish: The Birth of the Prison*. 2nd Vintage Books ed. New York: Vintage Books. ISBN: 978-0-679-75255-4.

Francis, K. B. et al. (Dec. 2017). “Simulating Moral Actions: An Investigation of Personal Force in Virtual Moral Dilemmas”. In: *Scientific Reports* 7.1. ISSN: 2045-2322. DOI: 10.1038/s41598-017-13909-9. URL: <http://www.nature.com/articles/s41598-017-13909-9> (visited on 02/25/2019).

Frasca, Gonzalo (1999). “Ludology meets Narratology: Similitude and differences between (video)games and narrative.” In: *Parnasso* 3. Ludologia kohtaa narratologian. URL: <https://ludology.typepad.com/weblog/articles/ludology.htm> (visited on 06/19/2019).

— (2003). “Ludologists Love Stories, Too: Notes from a Debate That Never Took Place.” In: *DIGRA Conf*. URL: http://www.ludology.org/articles/frasca_levelUP2003.pdf (visited on 09/23/2015).

— (2007). “Play the Message: Play, Game and Videogame Rhetoric”. Copenhagen, Denmark: IT University of Copenhagen. URL: http://www.powerfulrobot.com/Frasca_Play_the_Message_PhD.pdf (visited on 06/08/2016).

Frayling, Christopher (1993). *Research in Art and Design*. London: Royal College of Art. ISBN: 978-1-874175-55-1.

Friedman, Ken (2008). “Research into, by and for Design”. In: *Journal of Visual Art Practice* 7.2, pp. 153–160. URL: http://www.tandfonline.com/doi/abs/10.1386/jvap.7.2.153_1 (visited on 09/04/2015).

Fuchs, Mathias et al. (2014). *Rethinking Gamification*. meson Press by Hybrid Publishing Lab. URL: <http://opus.uni-lueneburg.de/opus/volltexte/2014/14305/> (visited on 09/05/2015).

Fukuyama, Francis (2012). *The End of History and the Last Man*. reissued. OCLC: 961799771. London: Penguin Books. ISBN: 978-0-241-96024-0.

Fuller, Steve (2011). *Humanity 2.0: What It Means to Be Human Past, Present and Future*. Houndmills, Basingstoke, Hampshire ; New York: Palgrave Macmillan.

- (2018). *Post-Truth: Knowledge As A Power Game*. Anthem Press. ISBN: 978-1-78308-693-1. JSTOR: j.ctvgd30v.
- Fullerton, Tracy (2008). *Game Design Workshop: A Playcentric Approach to Creating Innovative Games*. In collab. with Christopher Swain and Steven Hoffman. 2nd ed. Amsterdam ; Boston: Elsevier Morgan Kaufmann. ISBN: 978-0-240-80974-8.
- Gadamer, Hans-Georg (2004). *Truth and Method*. 2nd, rev. ed. Continuum Impacts. London ; New York: Continuum [1960]. ISBN: 978-0-8264-7697-5.
- Gage, Suzanne H. and Harry R. Sumnall (May 2019). “Rat Park: How a Rat Paradise Changed the Narrative of Addiction”. In: *Addiction* 114.5, pp. 917–922. ISSN: 0965-2140, 1360-0443. DOI: 10.1111/add.14481. URL: <https://onlinelibrary.wiley.com/doi/abs/10.1111/add.14481> (visited on 02/17/2020).
- Gaina, Raluca D., Simon M. Lucas, and Diego Perez-Liebana (June 10, 2019). “Project Thyia: A Forever Gameplayer”. In: arXiv: 1906.04023 [cs]. URL: <http://arxiv.org/abs/1906.04023> (visited on 09/05/2019).
- Galanter, Philip (2003). “What Is Generative Art? Complexity Theory as a Context for Art Theory”. In: GA2003 – 6th Generative Art Conference, p. 21.
- Gall, Allister Thomas (2016). “Towards a Cinema of Imperfection: Participatory Film as Research”. In: URL: <https://pearl.plymouth.ac.uk/handle/10026.1/5222> (visited on 02/16/2017).
- Galloway, Alexander R. (2014). *Laruelle: Against the Digital*. Posthumanities 31. Minneapolis: University of Minnesota Press.
- Gangle, Rocco (2013). “Situating Philosophies of Difference”. In: *François Laruelle's Philosophies of Difference: A Critical Introduction and Guide*. Edinburgh University Press, pp. 1–27. JSTOR: 10.3366/j.ctt1g0b3gr.4.
- Gardner, Howard (1998). *The Mind's New Science: A History of the Cognitive Revolution*. Paperback ed., Nachdr. New York: Basic Books. ISBN: 978-0-465-04635-5.
- Gehmann, Ulrich and Martin Reiche, eds. (2014). *Real Virtuality: About the Destruction and Multiplication of World*. Edition Kulturwissenschaften 37. Bielefeld: Transcript. ISBN: 978-3-8376-2608-7.
- Gennawey, Sam (2014). *Walt Disney and the Promise of Progress City*. Ed. by Werner Weiss. OCLC: ocn930265323. Orlando, Florida: Theme Park Press. ISBN: 978-1-941500-26-2.

- Gerstner, Wulfram and Werner M. Kistler (2002). *Spiking Neuron Models: Single Neurons, Populations, Plasticity*. Cambridge, U.K. ; New York: Cambridge University Press. ISBN: 0-521-81384-0.
- Gibson, James J. (1977). "The Theory of Affordances." In: *Perceiving, Acting, and Knowing: Toward an Ecological Psychology*. Ed. by Robert Shaw and John Bransford. Hillsdale, N.J. : New York: Lawrence Erlbaum Associates ; distributed by the Halsted Press Division, Wiley.
- Gibson, William (2011). *Idoru*. OCLC: 751503795. London: Penguin. ISBN: 978-0-241-95352-5.
- Gigerenzer, Gerd and Daniel G. Goldstein (1996). "Mind as Computer: Birth of a Metaphor". In: *Creativity Research Journal* 9.2-3, pp. 131–144.
- Gilbert, Allan H. (July 1926). "The Aristotelian Catharsis". In: *The Philosophical Review* 35.4, p. 301. ISSN: 00318108. DOI: 10.2307/2178979. URL: <https://www.jstor.org/stable/2178979?origin=crossref> (visited on 08/06/2019).
- Gill, Sam D. (2012). *Dancing Culture Religion*. Studies in Body & Religion. Lanham: Lexington Books. ISBN: 978-0-7391-7472-2. URL: <http://sam-gill.com/dancing-culture-religion/>.
- Glanville, R. (2002). *Second Order Cybernetics*. In: *Systems Science and Cybernetics. Encyclopedia of Life Support Systems (EOLSS), Developed under the Auspices of the UNESCO*. Ed. by F. Parra-Luna. Paris: Eolss Publishers, URL: <http://cepa.info/2708>.
- Glanville, Ranulph (Jan. 1982). "Inside Every White Box There Are Two Black Boxes Trying to Get Out". In: *Behavioral Science* 27.1, pp. 1–11. ISSN: 00057940, 10991743. DOI: 10.1002/bs.3830270102. URL: <http://doi.wiley.com/10.1002/bs.3830270102> (visited on 04/16/2019).
- (2001). "An Observing Science". In: *Foundations of Science* 6.1-3, pp. 45–75.
- Gödel, Kurt (1931). "Über Formal Unentscheidbare Sätze Der Principia Mathematica Und Verwandter Systeme I". In: *Monatshefte für Mathematik und Physik* 38.1, pp. 173–198.
- Goffman, Erving (1990a). *Stigma: Notes on the Management of Spoiled Identity*. Penguin Psychology. OCLC: 831356723. London: Penguin.
- (1990b). *The Presentation of Self in Everyday Life*. Repr. OCLC: 832784223. London: Penguin. ISBN: 978-0-14-013571-8.

- Goldstein, Caroline (Apr. 13, 2017). *How Many Animals Have Died for Damien Hirst's Art to Live? We Counted*. URL: <https://news.artnet.com/art-world/damien-whats-your-beef-916097> (visited on 06/23/2019).
- Goldstein, Jeffrey H. (Oct. 27, 2001). "Does Playing Violent Video Games Cause Aggressive Behavior?" In: *Playing by the Rules*. University of Chicago. URL: <https://web.archive.org/web/20040603151521/http://culturalpolicy.uchicago.edu/conf2001/papers/goldstein.html>.
- Google VR (2016). *Manufacture Cardboard – Google VR*. URL: <https://arvr.google.com/cardboard/manufacturers/> (visited on 02/16/2020).
- Goriunova, Olga, ed. (2014). *Fun and Software: Exploring Pleasure, Paradox, and Pain in Computing*. New York: Bloomsbury Academic. ISBN: 978-1-62356-094-2.
- Grall-Bronnec, Marie et al. (Jan. 2017). "Excessive Trading, a Gambling Disorder in Its Own Right? A Case Study on a French Disordered Gamblers Cohort". In: *Addictive Behaviors* 64, pp. 340–348. ISSN: 03064603. DOI: 10.1016/j.addbeh.2015.12.006. URL: <https://linkinghub.elsevier.com/retrieve/pii/S0306460315300721> (visited on 09/16/2019).
- Gramazio, Holly (Feb. 19, 2018). *Re: Now Play This*. E-mail.
- Grant, Jane, John Matthias, and Nick Ryan (2008b). *The Neurogranular Sampler*. Plymouth University: Art and sound research group.
- Griffiths, M. D. and Mark N. O. Davies (2005). "Does Videogame Addiction Exist?" In: *Handbook of Computer Game Studies*. Ed. by Joost Raessens and Jeffrey H. Goldstein. OCLC: ocm55518419. MIT Press, pp. 359–368. ISBN: 978-0-262-18240-9.
- Griffiths, Mark D., Daria J. Kuss, and Daniel L. King (Oct. 1, 2012). "Video Game Addiction: Past, Present and Future". In: *Current Psychiatry Reviews* 8.4, pp. 308–318. ISSN: 15734005. DOI: 10.2174/157340012803520414. URL: <http://www.eurekaselect.com/openurl/content.php?genre=article&issn=1573-4005&volume=8&issue=4&spage=308> (visited on 03/04/2019).
- Groos, Karl (1898). *The Play of Animals*. In collab. with James Mark Baldwin and University of Michigan. Trans. by Elizabeth L. Baldwin. New York, D. Appleton and Company. URL: <http://archive.org/details/playanimals00baldgoog> (visited on 10/24/2014).
- Gsöllpointner, Katharina (2015). "Die Kunst der Sinne – die Sinne der Kunst." In: *Exploring Cybernetics*. Ed. by Sabina Jeschke, Robert Schmitt, and Alicia Dröge. Wiesbaden: Springer Fachmedien Wiesbaden, pp. 137–165. DOI: 10.1007/978-3-658-11755-9_7.

URL: http://link.springer.com/10.1007/978-3-658-11755-9_7 (visited on 09/04/2019).

Guastello, Stephen J, Matthijs Koopmans, and David Pincus (2009). *Chaos and Complexity in Psychology: The Theory of Nonlinear Dynamical Systems*. Cambridge; New York: Cambridge University Press.

Guckelsberger, Christian et al. (2017). "Predicting Player Experience without the Player.: An Exploratory Study". In: *Proceedings of the Annual Symposium on Computer-Human Interaction in Play - CHI PLAY '17*. The Annual Symposium. Amsterdam, The Netherlands: ACM Press, pp. 305–315. ISBN: 978-1-4503-4898-0. DOI: 10.1145/3116595.3116631. URL: <http://dl.acm.org/citation.cfm?doid=3116595.3116631> (visited on 02/20/2019).

Günther, Gotthard (1962). "Cybernetic Ontology and Transjunctional Operations". In: *vordenker* 45.

Haeckel, Ernst (1866). *Von Den Entwickelten Formen Der Organismen, Begründet Durch Die Descendenz-Theorie*. Berlin: G. Reimer.

Hans, James S. (1981). *The Play of the World*. Amherst: University of Massachusetts Press. ISBN: 0-87023-324-6.

Haraway, Donna Jeanne (1991). "A Cyborg Manifesto". In: *Simians, Cyborgs, and Women: The Reinvention of Nature*. New York: Routledge, pp. 149–184.

— (1997). *Modest_WitnessSecond_Millennium. FemaleMan@_Meets_OncoMouseTM: Feminism and Technoscience*. OCLC: 832697944. New York London: Routledge.

Hardman, Michael (2011). *Understanding Guerrilla Gardening: An Exploration of Illegal Cultivation in the UK*. OCLC: 884991538. ISBN: 978-1-904839-44-6.

Harman, Gilbert (1973). *Thought*. Princeton: Princeton University Press.

Harvey, Hayden et al. (Nov. 2014). "Innocent Fun or 'Microslavery'? An Ethical Analysis of Biotic Games". In: *Hastings Center Report* 44.6, pp. 38–46. ISSN: 00930334. DOI: 10.1002/hast.386. URL: <http://doi.wiley.com/10.1002/hast.386> (visited on 06/24/2019).

Haseman, Brad (2006). "A Manifesto for Performative Research". In: *Media International Australia, Incorporating Culture & Policy* 118, p. 98. URL: <http://search.informit.com.au/documentSummary;dn=010497030622521;res=IELLCC> (visited on 09/09/2014).

Hayes, Patrick and Kenneth Ford (1995). "Turing Test Considered Harmful". In: *IJCAI (1)*, pp. 972–977. URL: http://www.researchgate.net/profile/Kenneth_Ford/

publication/220813820_Turing_Test_Considered_Harmful/links/09e4150d1dc67df32c000000.pdf (visited on 04/12/2015).

Hayles, Katherine (2017). *Unthought: The Power of the Cognitive Nonconscious*. Chicago ; London: The University of Chicago Press.

Heidegger, Martin (2013). *Being and Time*. 35. reprint. Malden: Blackwell [1962]. ISBN: 978-0-631-19770-6.

Hemment, Drew (2006). "Locative Arts". In: *Leonardo* 39.4, pp. 348–355. URL: <http://www.mitpressjournals.org/doi/abs/10.1162/leon.2006.39.4.348> (visited on 12/17/2015).

Henricks, Thomas (2008). "The Nature of Play". In: *American Journal of Play* 1.2, pp. 157–180. URL: <http://www.journalofplay.org/sites/www.journalofplay.org/files/pdf-articles/1-2-article-the-nature-of-play.pdf> (visited on 09/25/2014).

Hernández-Orallo, José (2014). "AI Evaluation: Past, Present and Future". In: *arXiv preprint arXiv:1408.6908*. URL: <http://arxiv.org/abs/1408.6908> (visited on 09/22/2015).

Herrera, Fernanda et al. (Oct. 17, 2018). "Building Long-Term Empathy: A Large-Scale Comparison of Traditional and Virtual Reality Perspective-Taking". In: *PLOS ONE* 13.10. Ed. by Brock Bastian, e0204494. ISSN: 1932-6203. DOI: 10.1371/journal.pone.0204494. URL: <http://dx.plos.org/10.1371/journal.pone.0204494> (visited on 02/25/2019).

Herrington, Jan et al. (2007). "Design-Based Research and Doctoral Students: Guidelines for Preparing a Dissertation Proposal". In: URL: <http://researchrepository.murdoch.edu.au/6762/> (visited on 09/06/2014).

Hertz, Garnet (2002). "Ethology of Art and Science Collaborations: Research Ethics Boards in the Context of Contemporary Art Practice". Bridges II Conference (Banff New Media Institute). URL: <http://www.conceptlab.com/ethology/>.

Hilgard, Joseph, Christopher R. Engelhardt, and Bruce D. Bartholow (2013). "Individual Differences in Motives, Preferences, and Pathology in Video Games: The Gaming Attitudes, Motives, and Experiences Scales (GAMES)". In: *Frontiers in Psychology* 4. ISSN: 1664-1078. DOI: 10.3389/fpsyg.2013.00608. URL: <http://journal.frontiersin.org/article/10.3389/fpsyg.2013.00608/abstract> (visited on 01/09/2016).

Hingston, Philip (Sept. 2009). "A Turing Test for Computer Game Bots". In: *IEEE Transactions on Computational Intelligence and AI in Games* 1.3, pp. 169–186. ISSN: 1943-

- 068X, 1943-0698. DOI: 10.1109/TCIAIG.2009.2032534. URL: <http://ieeexplore.ieee.org/lpdocs/epic03/wrapper.htm?arnumber=5247069> (visited on 04/13/2015).
- ed. (2012). *Believable Bots: Can Computers Play like People?* Berlin ; New York: Springer. ISBN: 978-3-642-32322-5.
- Hinton, Geoffrey, Simon Osindero, and Yee-Whye Teh (2006). "A Fast Learning Algorithm for Deep Belief Nets". In: *Neural computation* 18.7, pp. 1527–1554. URL: http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6796673 (visited on 04/13/2015).
- Hjelm, Sara Ilstedt (2003). "The Making of Brainball". In: *Interactions* 10.1, pp. 26–34.
- Hofstadter, Douglas R. (1999). *Gödel, Escher, Bach: An Eternal Golden Braid*. 20. anniversary ed. OCLC: 722969077. New York: Basic Books.
- Houde, Stephanie and Charles Hill (1997). "What Do Prototypes Prototype?" In: *Handbook of Human-Computer Interaction*.
- Howard, David and Edward Mabley (1996). *The Tools of Screenwriting: A Writer's Guide to the Craft and Elements of a Screenplay*. New York: St. Martin's. ISBN: 978-0-312-11908-9.
- Huggins, Jason (Apr. 21, 2012). "Teaching a Robot to Play Angry Birds". URL: <http://www.slideshare.net/hugs/selenium-conf-robots> (visited on 02/04/2015).
- Huizinga, Johan (1955). *Homo Ludens: A Study of the Play-Element in Culture*. Boston: Beacon Press.
- Hull, John M (2013). *Touching the Rock: An Experience of Blindness*. OCLC: 847942640. ISBN: 978-0-281-07073-2.
- Hunicke, Robin, Marc LeBlanc, and Robert Zubek (2004). "MDA: A Formal Approach to Game Design and Game Research". In: *Proceedings of the AAAI Workshop on Challenges in Game AI*, pp. 04–04. URL: <http://www.aaai.org/Papers/Workshops/2004/WS-04-04/WS04-04-001.pdf> (visited on 09/06/2014).
- Huntington, Samuel P. (1993). "The Clash of Civilizations?" In: *Foreign Affairs* 72.3, p. 22. ISSN: 00157120. DOI: 10.2307/20045621. URL: <https://www.jstor.org/stable/10.2307/20045621?origin=crossref> (visited on 08/13/2019).
- Huxley, Julian (1912). *The Individual in the Animal Kingdom*. Woodbridge, Conn: Ox Bow Press. ISBN: 978-1-881987-05-5.
- Iba, Takashi (2010). "An Autopoietic Systems Theory for Creativity". In: *Procedia - Social and Behavioral Sciences* 2.4, pp. 6610–6625. ISSN: 18770428. DOI: 10.1016/j.

- sbspro.2010.04.071. URL: <https://linkinghub.elsevier.com/retrieve/pii/S1877042810011298> (visited on 06/27/2019).
- Ingold, Tim (2016). *Evolution and Social Life*. Routledge Classic Texts in Anthropology 2. OCLC: 933449697. Abingdon, Oxon New York: Routledge.
- Iversen, Margaret, ed. (2010). *Chance*. Documents of Contemporary Art. OCLC: ocn457159697. London : Cambridge, Mass: Whitechapel Gallery ; MIT Press. ISBN: 978-0-262-51392-0.
- Izhikevich, E.M. (Sept. 2004). "Which Model to Use for Cortical Spiking Neurons?" In: *IEEE Transactions on Neural Networks* 15.5, pp. 1063–1070. ISSN: 1045-9227. DOI: 10.1109/TNN.2004.832719. URL: <http://ieeexplore.ieee.org/lpdocs/epic03/wrapper.htm?arnumber=1333071> (visited on 09/17/2014).
- Izhikevich, Eugene M (2007). *Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting*. Cambridge, Mass.: MIT Press. URL: <http://site.ebrary.com/id/10173655> (visited on 07/15/2014).
- (2003). "Simple Model of Spiking Neurons". In: *IEEE Transactions on neural networks* 14.6, pp. 1569–1572.
- Jackson, Steve (1998). *Killer, the Game of Assassination*. OCLC: 475159756. Austin, Tex.: Steve Jackson Games. ISBN: 978-1-55634-351-3.
- Jadlow, Janice W. and John C. Mowen (June 8, 2010). "Comparing the Traits of Stock Market Investors and Gamblers". In: *Journal of Behavioral Finance* 11.2, pp. 67–81. ISSN: 1542-7560, 1542-7579. DOI: 10.1080/15427560.2010.481978. URL: <http://www.tandfonline.com/doi/abs/10.1080/15427560.2010.481978> (visited on 09/16/2019).
- Jahraus, Oliver et al., eds. (2012). *Luhmann-Handbuch: Leben–Werk–Wirkung*. OCLC: ocn815378870. Stuttgart: Verlag J.B. Metzler. ISBN: 978-3-476-02368-1.
- Jahrman, Margarete (2011). "Ludics for a Ludic Society. The Art and Politics of Play". URL: <http://pearl.plymouth.ac.uk:8080/handle/10026.1/453> (visited on 05/02/2014).
- Jahrman, Margarete and Brigitte Felderer (2013). *Play & Prosume: Schleichende Werbung Und Schnelle Avantgarde*. ISBN: 978-3-86984-411-4.
- James, William (1890). *The Principles of Psychology*. New York: Holt.
- Japan Times (Nov. 12, 2018). "Love in Another Dimension: Japanese Man 'marries' Hatsune Miku Hologram". In: *The Japan Times Online*. ISSN: 0447-5763. URL: <https://www.japantimesonline.com/love-in-another-dimension-japanese-man-marries-hatsune-miku-hologram/>

- <http://www.japantimes.co.jp/news/2018/11/12/national/japanese-man-marries-virtual-reality-singer-hatsune-miku-hologram/> (visited on 08/17/2019).
- Jarrold, Chris et al. (1994). "Pretend Play: Is It Metarepresentational?" In: *Mind & Language* 9.4, pp. 445–468. ISSN: 1468-0017. DOI: 10.1111/j.1468-0017.1994.tb00318.x. URL: <http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0017.1994.tb00318.x/abstract> (visited on 01/19/2015).
- Järvinen, Aki (2008). "Games without Frontiers - Theories and Methods for Game Studies and Design". Tampere University.
- Jiang, Yun and Ashutosh Saxena (2013). "Hallucinating Humans for Learning Robotic Placement of Objects". In: *Experimental Robotics*. Springer, pp. 921–937. URL: http://link.springer.com/chapter/10.1007/978-3-319-00065-7_61 (visited on 01/19/2015).
- Johnsen, Sarah, Suzanne Fitzpatrick, and Beth Watts (Oct. 3, 2018). "Homelessness and Social Control: A Typology". In: *Housing Studies* 33.7, pp. 1106–1126. DOI: 10.1080/02673037.2017.1421912. URL: <https://www.tandfonline.com/doi/full/10.1080/02673037.2017.1421912> (visited on 05/26/2019).
- Jones, Jonathan (Nov. 30, 2012). "Sorry MoMA, Video Games Are Not Art". In: *The Guardian Online*.
- Jonsson, Staffan et al. (2007). "Game Mastering a Pervasive Larp – Experiences from Momentum". In: *Proceedings of the 4th International Symposium on Pervasive Gaming Applications: PerGames 2007*. Salzburg, pp. 31–39.
- Jung, Carl (1961). *The Seven Sermons to the Dead*. Random House [1916].
- Juno, Andrea, V. Vale, and J. G. Ballard, eds. (1987). *Pranks!* RE/Search no. 11. OCLC: ocm18073467. San Francisco, Calif: Re/Search Publications. ISBN: 978-0-940642-10-2.
- Justesen, Niels, Michael S Debus, and Sebastian Risi (Aug. 21, 2019). "When Are We Done with Games?" In: IEEE Conference on Games (COG). London.
- Juul, Jesper (2005). *Half-Real: Video Games between Real Rules and Fictional Worlds*. Cambridge, Mass.: MIT Press.
- (2013). *The Art of Failure: An Essay on the Pain of Playing Video Games*. Playful Thinking. OCLC: 855552216. Cambridge, Mass.: MIT Press.
- (July 25, 2019). "Virtual Reality: Fictional All the Way Down (and That's OK)". In: *Disputatio* 0.0. ISSN: 0873-626X. DOI: 10.2478/disp-2019-0010. URL: <http://>

content.sciendo.com/view/journals/disp/ahead-of-print/article-10.2478-disp-2019-0010.xml (visited on 09/02/2019).

Kac, Eduardo (Dec. 1998). "Transgenic Art". In: *Leonardo Electronic Almanac* 6.11.

Kac, Eduardo (2005). *Telepresence & Bio Art: Networking Humans, Rabbits, & Robots*. Studies in Literature and Science. OCLC: 260114679. Ann Arbor: University of Michigan Press.

Kanary Nikolov(a), Jennifer (2016b). "Labyrinth Psychotica - Simulating Psychotic Phenomena". Doctoral Thesis. Plymouth: University of Plymouth. URL: <https://pearl.plymouth.ac.uk/handle/10026.1/5509>.

Kant, Immanuel (1993). *Grounding for the Metaphysics of Morals*. 3rd ed. Indianapolis: Hackett Pub. Co [1785].

— (2007). *Critique of Pure Reason*. Penguin Classics. London: Penguin Books [1781]. ISBN: 978-0-14-044747-7.

Kaprow, Allan (2003). *Essays on the Blurring of Art and Life*. Ed. by Jeff Kelley. Expanded pbk. ed. Berkeley, Calif: University of California Press. ISBN: 978-0-520-24079-7.

Karpathy, Andrej (2015). *Reinforce.js*. URL: <https://cs.stanford.edu/people/karpathy/reinforcejs/>.

Karpov, Igor V., Jacob Schrum, and Risto Miikkulainen (2012). "Believable Bot Navigation via Playback of Human Traces". In: *Believable Bots*. Ed. by Philip F. Hingston. Springer Berlin Heidelberg, pp. 151–170. URL: <http://nn.cs.utexas.edu/?karpov:believablebots12>.

Keeling, Geoff (Feb. 16, 2017). "Blame in Autonomous Vehicle Collisions". In: *AISB 2017*.

Kirkup, James and Robert Winnett (May 25, 2012). "Theresa May Interview: 'We're Going to Give Illegal Migrants a Really Hostile Reception'". In: *The Telegraph. News*. ISSN: 0307-1235. URL: <https://www.telegraph.co.uk/news/uknews/immigration/9291483/Theresa-May-interview-Were-going-to-give-illegal-migrants-a-really-hostile-reception.html> (visited on 05/27/2019).

Kitcher, P. (June 4, 2010). "The Climate Change Debates". In: *Science* 328.5983, pp. 1230–1234. ISSN: 0036-8075, 1095-9203. DOI: 10.1126/science.1189312. URL: <http://www.sciencemag.org/cgi/doi/10.1126/science.1189312> (visited on 09/10/2019).

Kittler, Friedrich A. (1990). *Discourse Networks 1800/1900*. OCLC: 722138421. Stanford, Calif: Stanford University Press.

- Klevjer, Rune (2012). "Enter the Avatar. The Phenomenology of Prosthetic Telepresence in Computer Games." In: *The Philosophy of Computer Games*. Ed. by John Richard Sageng, Hallvard Fossheim, and Tarjei Mandt Larsen. OCLC: 800347212. Dordrecht: Springer, pp. 17–38. ISBN: 978-94-007-4249-9. URL: <http://public.eblib.com/choice/publicfullrecord.aspx?p=971877> (visited on 07/05/2016).
- Kollman, Ken (2012). "The Potential Value of Computational Models in Social Science Research". In: *The Oxford Handbook of Philosophy of Social Science*. Ed. by Harold Kincaid. Oxford ; New York: Oxford University Press, pp. 355–384. ISBN: 978-0-19-539275-3. URL: <http://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780195392753.001.0001/oxfordhb-9780195392753-e-15>.
- Kolnai, Aurel (1965). "Games and Aims". In: *Proceedings of the Aristotelian Society* 66.n/a, pp. 103–128.
- Komlosy, Andrea (2018). *Work: The Last 1,000 Years*. London ; New York: Verso.
- Konior, Bogna M. (2016). "Alien Aesthetics: Xenofeminism and Nonhuman Animals". In: *Proceedings of the 22nd International Symposium on Electronic Art*. Hong Kong.
- Koskela, Mari Erika (2016). "Studying the Field of Game Studies". Master's Thesis. University of Jyväskylä.
- Koster, Raph (2013). *A Theory of Fun for Game Design*. 2nd ed. OCLC: 864519232. Sebastopol, CA: O'Reilly. ISBN: 978-1-4493-6321-5.
- Krauss, Lawrence M. (1997). *The Physics of Star Trek*. OCLC: 832883741. London: Flamingo. ISBN: 978-0-00-655042-6.
- Kristeva, Julia (1980). *Desire in Language: A Semiotic Approach to Literature and Art*. European Perspectives. New York: Columbia University Press. ISBN: 978-0-231-04806-4.
- Kršiak, Miloslav (2011). "Tinbergen's Four Questions, Biologically Useless Behavior and Humanistic Ethology". In: *Activitas Nervosa Superior Rediviva* 53.3, pp. 103–106. URL: <http://rediviva.sav.sk/53i3/103.pdf> (visited on 08/31/2015).
- Kubin, Felix (June 25, 2019). *Re: Noise*. E-mail.
- Kücklich, Julian (2005). "Precarious Playbour: Modders and the Digital Games Industry". In: *The Fibreculture Journal* 5. URL: <http://five.fibreculturejournal.org/fcj-025-precious-playbour-modders-and-the-digital-games-industry/> (visited on 09/22/2019).

- Kuhn, Thomas S. (1962). *The Structure of Scientific Revolutions*. Chicago ; London: The University of Chicago Press.
- Kurzweil, Ray (2009). *The Singularity Is near: When Humans Transcend Biology*. OCLC: 845813950. London: Duckworth. ISBN: 978-0-7156-3561-2.
- Kurzweil, Ray (2014). *How to Create a Mind: The Secret of Human Thought Revealed*. Duckworth.
- Laboria Cuboniks (2018). *The Xenofeminist Manifesto: A Politics for Alienation*. Brooklyn: Verso. ISBN: 978-1-78873-157-7.
- Lakoff, George (2012). *Women, Fire, and Dangerous Things: What Categories Reveal about the Mind*. paperback ed., [Nachdr.] OCLC: 935630820. Chicago: The Univ. of Chicago Press. ISBN: 978-0-226-46804-4.
- Langer, Ellen J. (2014). *Mindfulness*. 25th anniversary edition. Boston, MA: Da Capo Press. ISBN: 978-0-7382-1799-4.
- Lankoski, Petri and Staffan Björk, eds. (2015). *Game Research Methods: An Overview*. Pittsburgh, PA: ETC Press. ISBN: 978-1-312-88473-1.
- Lankoski, Petri and Jussi Holopainen (Dec. 20, 2017). *Game Design Research: An Introduction to Theory & Practice*. Carnegie Mellon University: ETC Press. ISBN: 978-1-387-40836-8.
- Lanza, Joseph (2004). *Elevator Music: A Surreal History of Muzak, Easy-Listening, and Other Moodsong*. Ann Arbor, MI: University of Michigan Press. ISBN: 978-0-472-08942-0. DOI: 10.3998/mpub.8718. URL: <http://www.press.umich.edu/8718> (visited on 08/16/2018).
- Laruelle, François (2010). *Philosophies of Difference: A Critical Introduction to Non-Philosophy*. OCLC: ocn496962246. London ; New York: Continuum. ISBN: 978-0-8264-3663-4.
- Latour, Bruno (1998). "On Recalling ANT". In: *Actor Network Theory and After*. Ed. by John Law and John Hassard. Oxford: Blackwell Publishers, pp. 15–25.
- (1999a). "A Collective of Humans and Nonhumans: Following Daedalus's Labyrinth". In: *Pandora's Hope: Essays on the Reality of Science Studies*. Cambridge, Mass: Harvard University Press, pp. 174–215.
- (1999b). *Pandora's Hope: Essays on the Reality of Science Studies*. OCLC: 231788057. Cambridge, Mass.: Harvard Univ. Press.

- (2005). *Reassembling the Social: An Introduction to Actor-Network-Theory*. Clarendon Lectures in Management Studies. Oxford ; New York: Oxford University Press. ISBN: 0-19-925604-7.
- Leinberger, Christopher B. and Patrick Lynch (2014). “Ranking Walkable Urbanism in America’s Largest Metros”. In: URL: <http://fundrise-cms.s3.amazonaws.com/fundrise-cms-1405956683.pdf> (visited on 01/25/2015).
- Levy, Joseph (1978). *Play Behavior*. New York: Wiley. ISBN: 0-471-01712-4.
- Leyden, Kevin M. (2003). “Social Capital and the Built Environment: The Importance of Walkable Neighborhoods”. In: *American journal of public health* 93.9, pp. 1546–1551. URL: <http://ajph.aphapublications.org/doi/abs/10.2105/AJPH.93.9.1546> (visited on 01/25/2015).
- Lieberoth, Andreas and Andreas Roepstorff (2015). “Mixed Methods in Game Research. Playing on Strengths and Countering Weaknesses”. In: *Game Research Methods: An Overview*. Ed. by Petri Lankoski and Staffan Björk. Pittsburgh, PA: ETC Press, pp. 271–289. ISBN: 978-1-312-88473-1.
- Livingstone, Daniel (2006). “Turing’s Test and Believable AI in Games”. In: *Computers in Entertainment (CIE)* 4.1, p. 6. URL: <http://dl.acm.org/citation.cfm?id=1111303> (visited on 04/11/2015).
- Llagostera, Enric (2012). “On Gamification and Persuasion”. In: *SBC - Proceedings of SBGames 2012*. Brasília, pp. 12–21.
- Luhmann, Niklas (1993). “Observing Re-Entries”. In: *Graduate Faculty Philosophy Journal* 16.2, pp. 485–498. ISSN: 0093-4240. DOI: 10.5840/gfpj199316227. URL: http://www.pdcnet.org/oom/service?url_ver=Z39.88-2004&rft_val_fmt=&rft.imuse_id=gfpj_1993_0016_0002_0485_0498&svc_id=info:www.pdcnet.org/collection (visited on 07/22/2019).
- (1996). *Social Systems*. Writing Science. Stanford University Press.
- (2000). *Art as a Social System*. Meridian, Crossing Aesthetics. Stanford University Press.
- (2002). *Theories of Distinction: Redescribing the Descriptions of Modernity*. Ed. by William Rasch. Cultural Memory in the Present. Stanford, Calif: Stanford University Press.
- (2008). *Die Wirtschaft der Gesellschaft*. OCLC: 551356299. Frankfurt am Main: Suhrkamp. ISBN: 978-3-518-28752-1.

- (2009). *Die Wissenschaft der Gesellschaft*. Frankfurt am Main: Suhrkamp. ISBN: 978-3-518-28601-2.
- (2012). *Theory of Society. Vol. 1: ...* Stanford, Calif: Stanford Univ. Press.
- (2013). *Theory of Society. Vol. 2: ...* Stanford, Calif: Stanford Univ. Press.
- Magerkurth, Carsten, ed. (June 2007). *Proceedings of the 4th International Symposium on Pervasive Gaming Applications: PerGames 2007*. OCLC: 180747551. Aachen: Shaker. ISBN: 978-3-8322-6288-4.
- Marenko, Betti (2018). "FutureCrafting: A Speculative Method for an Imaginative AI". In: The 2018 AAAI Spring Symposium Series. Stanford: Stanford University, pp. 419–422.
- Marriott, James and Mika Minio-Paluello (2013). *The Oil Road: Journeys from the Caspian Sea to the City of London*. OCLC: 889872587. London; Brooklyn, NY: Verso. ISBN: 978-1-78168-128-2.
- Martin, Paul and T. M. Caro (1985). "On the Functions of Play and Its Role in Behavioral Development". In: *Advances in the Study of Behavior*. Ed. by Colin Beer Jay S. Rosenblatt Marie-Claire Busnel and Peter J. B. Slater. Vol. 15. Academic Press, pp. 59–103. URL: <http://www.sciencedirect.com/science/article/pii/S0065345408604878> (visited on 01/11/2015).
- Marzbani, H., H. Marateb, and M. Mansourian (2016). "Methodological Note: Neuro-feedback: A Comprehensive Review on System Design, Methodology and Clinical Applications". In: *Basic and Clinical Neuroscience Journal* 7.2. ISSN: 22287442. DOI: 10.15412/J.BCN.03070208. URL: http://bcn.iuims.ac.ir/browse.php?a_id=608&sid=1&slc_lang=en (visited on 05/28/2019).
- Mason, S.G. and G.E. Birch (Mar. 2003). "A General Framework for Brain-Computer Interface Design". In: *IEEE Transactions on Neural Systems and Rehabilitation Engineering* 11.1, pp. 70–85. ISSN: 1534-4320. DOI: 10.1109/TNSRE.2003.810426. URL: <http://ieeexplore.ieee.org/document/1200910/> (visited on 05/28/2019).
- Massumi, Brian (2002). *Parables for the Virtual: Movement, Affect, Sensation*. Post-Contemporary Interventions. Durham, NC: Duke University Press.
- Mateas, Michael (2001). "Expressive AI - A Hybrid Art and Science Practice". In: *Leonardo: Journal of the International Society for Arts, Sciences, and Technology* 34.2, pp. 147–153.
- Matsumoto, Keigo et al. (2016). "Unlimited Corridor: Redirected Walking Techniques Using Visuo Haptic Interaction". In: *Proceedings of the SIGGRAPH '16 ACM SIGGRAPH*

- 2016 Emerging Technologies*. Anaheim, California: ACM Press, pp. 1–2. ISBN: 978-1-4503-4372-5. DOI: 10.1145/2929464.2929482. URL: <http://dl.acm.org/citation.cfm?doid=2929464.2929482> (visited on 10/24/2016).
- Matthias, John (2013). “Plasticity: Noise, Correlation and Interaction.” In: *Proceedings of the 19th International Symposium of Electronic Art*. ISEA. Sydney. ISBN: 978-0-646-91313-1. URL: <http://prijipati.library.usyd.edu.au/handle/2123/9671> (visited on 04/23/2014).
- Maturana, Humberto R. and Bernhard Pörksen (2004). *From Being to Doing: The Origins of the Biology of Cognition*. OCLC: 249959883. Heidelberg: Carl-Auer-Systeme-Verl. ISBN: 978-3-89670-448-1.
- Maturana, Humberto R. and Francisco J. Varela (1980). *Autopoiesis and Cognition: The Realization of the Living*. Boston Studies in the Philosophy of Science v. 42. Dordrecht, Holland; Boston: D. Reidel Pub. Co. ISBN: 90-277-1015-5.
- May, Todd (1997). *Reconsidering Difference: Nancy, Derrida, Levinas, and Deleuze*. University Park, Pa: Pennsylvania State University Press.
- Mäyrä, Frans, Jonne Arjoranta, et al. (2016). “Panel: From Game Culture to Playful Culture Studies: Emergence of Ludification”. In: DiGRA FDG Conference 2016. Dundee, Scotland.
- Mäyrä, Frans, Sybille Lammes, et al. (2015). “From Game Studies to Studies of Play in Society: A Panel”. In: DiGRA 2015: Diversity of Play: Games – Cultures – Identities. Lüneburg.
- McGinn, Colin (1996). *The Character of Mind: An Introduction to the Philosophy of Mind*. 2nd ed. Oxford ; New York: Oxford University Press. ISBN: 0-19-875209-1.
- McGonigal, Jane (2012). *Reality Is Broken*. OCLC: 934836626. London: Vintage Books. ISBN: 978-0-09-954028-1.
- McLuhan, Marshall (1994). *Understanding Media: The Extensions of Man*. 1st MIT Press ed. Original: 1964. Cambridge, Mass: MIT Press. ISBN: 978-0-262-63159-4.
- McLuhan, Marshall and Quentin Fiore (2008). *The Medium Is the Massage*. OCLC: 695678783. London: Penguin. ISBN: 978-0-14-103582-6.
- McMullin, Barry (2004). “Thirty Years of Computational Autopoiesis: A Review”. In: *Artificial life* 10.3, pp. 277–295. URL: <http://www.mitpressjournals.org/doi/abs/10.1162/1064546041255548> (visited on 02/04/2017).

- Mead, M. (1968). "Cybernetics of Cybernetics". In: *Purposive Systems*. Ed. by Peterson L. J. & Russell J. K. Foerster H. von White J. D. New York: Spartan Books, pp. 1–11. URL: <http://cepa.info/2634>.
- Meet The Man Behind The Holodeck, Part 1* (Mar. 11, 2014). In collab. with Gene Dolgoff and Gene Dolgoff. URL: <http://www.startrek.com/article/meet-the-man-behind-the-holodeck-part-1> (visited on 09/21/2018).
- Melhart, David et al. (Jan. 31, 2019). "Your Gameplay Says It All: Modelling Motivation in Tom Clancy's The Division". In: arXiv: 1902.00040 [cs, stat]. URL: <http://arxiv.org/abs/1902.00040> (visited on 02/20/2019).
- Melucci, Alberto (1996). *Challenging Codes: Collective Action in the Information Age*. Cambridge Cultural Social Studies. Cambridge [England] ; New York: Cambridge University Press.
- Memory Alpha Fandom Editors (Oct. 25, 2018). *Holodeck Safety Protocol*. URL: https://memory-alpha.fandom.com/wiki/Holodeck_safety_protocol (visited on 02/26/2019).
- Mendelson, Bert (2009). *Introduction to Topology*. 3. ed., [Nachdr.] Dover Books on Mathematics. OCLC: 831865944. Mineola, NY: Dover Publ. ISBN: 978-0-486-66352-4.
- Menninger, W. (1960). "Recreation and Mental Health". In: *Recreation and Psychiatry*. Ed. by B. Hill. New York: Oxford University Press, pp. 8–18.
- Mershon, Kevin and David Ng (Oct. 7, 2013). *Pynia*. URL: <https://github.com/kevinmershon/pynia>.
- Milgram, Paul and Fumio Kishino (1994). "A Taxonomy of Mixed Reality Visual Displays". In: *IEICE TRANSACTIONS on Information and Systems* 77.12, pp. 1321–1329. URL: http://search.ieice.org/bin/summary.php?id=e77-d_12_1321 (visited on 09/05/2015).
- Milgram, Paul, Haruo Takemura, et al. (1995). "Augmented Reality: A Class of Displays on the Reality-Virtuality Continuum". In: *Photonics for Industrial Applications*. International Society for Optics and Photonics, pp. 282–292. URL: <http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=981543> (visited on 09/09/2014).
- Milk, Chris, director (Mar. 2015). *How Virtual Reality Can Create the Ultimate Empathy Machine*. URL: https://www.ted.com/talks/chris_milk_how_virtual_reality_can_create_the_ultimate_empathy_machine (visited on 02/26/2019).

- Miller, John H. and Scott E. Page (2007). *Complex Adaptive Systems: An Introduction to Computational Models of Social Life*. Princeton Studies in Complexity. Princeton, N.J: Princeton University Press. ISBN: 0-691-12702-6.
- Miranda, Eduardo Reck and John Matthias (2005). “Granular Sampling Using a Pulse-Coupled Network of Spiking Neurons”. In: *Applications of Evolutionary Computing*. Springer, pp. 539–544. URL: http://link.springer.com/chapter/10.1007/978-3-540-32003-6_55 (visited on 02/22/2015).
- Mitchell, Elmer D. and W.P. Bowen (1923). *The Theory of Organized Play*. New York: A.S. Barnes.
- Mitchell, Melanie (2011). *Complexity: A Guided Tour*. Oxford; New York: Oxford University Press.
- Mnih, Volodymyr et al. (2013). “Playing Atari with Deep Reinforcement Learning”. In: *arXiv preprint arXiv:1312.5602*.
- Montola, Markus (2005). *Exploring the Edge of the Magic Circle: Defining Pervasive Games*. Integrated Project on Pervasive Games.
- (2009). *Pervasive Games: Theory and Design*. In collab. with Jaakko Stenros and Annika Wærn. Amsterdam ; Boston: Elsevier/Morgan Kaufmann. ISBN: 978-0-12-374853-9.
- (2012a). *On the Edge of the Magic Circle: Understanding Pervasive Games and Role-Playing*. Tampere University Press. ISBN: 978-951-44-8864-1. URL: <http://tampub.uta.fi/handle/10024/66937> (visited on 09/07/2014).
- (June 1, 2012b). “Social Constructionism and Ludology: Implications for the Study of Games”. In: *Simulation & Gaming* 43.3, pp. 300–320. ISSN: 1046-8781, 1552-826X. DOI: 10.1177/1046878111422111. URL: <http://sag.sagepub.com/content/43/3/300> (visited on 09/07/2014).
- Montola, Markus et al. (Oct. 13, 2006). *Ethics of Pervasive Gaming*. D5.5. Integrated Project on Pervasive Gaming.
- Morgan, William J. (Oct. 2008). “Some Further Words on Suits on Play”. In: *Journal of the Philosophy of Sport* 35.2, pp. 120–141. ISSN: 0094-8705, 1543-2939. DOI: 10.1080/00948705.2008.9714734. URL: <http://www.tandfonline.com/doi/abs/10.1080/00948705.2008.9714734> (visited on 04/19/2019).
- Mortensen, Torill Elvira (2016). “Anger, Fear, and Games: The Long Event of #GamerGate”. In: *Games and Culture* 13.8, pp. 787–806. ISSN: 1555-4120, 1555-4139. DOI: 10.

1177 / 1555412016640408. URL: <http://journals.sagepub.com/doi/10.1177/1555412016640408> (visited on 03/05/2019).

Mortensen, Torill Elvira, Jonas Linderöth, and Ashley M. L. Brown, eds. (2015). *The Dark Side of Game Play: Controversial Issues in Playful Environments*. Routledge Advances in Game Studies 4. New York: Routledge. ISBN: 978-1-138-82728-8.

Müller, Vincent C. and Nick Bostrom (2014). "Future Progress in Artificial Intelligence: A Survey of Expert Opinion". In: *Fundamental Issues of Artificial Intelligence*. URL: <http://www.nickbostrom.com/papers/survey.pdf> (visited on 09/24/2015).

Munari, Bruno (2008). *Design as Art*. OCLC: 611944118. London: Penguin Classics. ISBN: 978-0-14-103581-9.

Muriel, Daniel and Garry Crawford (Mar. 14, 2018). *Video Games As Culture: Considering the Role and Importance of Video Games in Contemporary Society*. Routledge. ISBN: 978-1-315-62274-3. URL: <https://www.taylorfrancis.com/books/9781317223931> (visited on 03/04/2019).

Murray, H. J. R. (2012). *A History of Chess: The Original 1913 Edition*. 1. ed.; originally publ. by Oxford Univ. Press in 1913. New York: Skyhorse Publishing.

Murray, James A.H., ed. (1970). *The Oxford English Dictionary Vol. VIII Poy-Ry*. OCLC: 257216354. Oxford: Oxford University Press.

Murray, Janet H. (June 28, 2013). *The Last Word on Ludology v Narratology*. URL: <http://inventingthemedium.com/2013/06/28/the-last-word-on-ludology-v-narratology-2005/> (visited on 02/04/2015).

Murray, Janet Horowitz (1998). *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. Cambridge, Mass: MIT Press. ISBN: 978-0-262-63187-7.

Myers, David (May 2012). "Game as Paradox: A Rebuttal of Suits". In: *Journal of the Philosophy of Sport* 39.1, pp. 155–168. ISSN: 0094-8705, 1543-2939. DOI: 10.1080/00948705.2012.675071. URL: <http://www.tandfonline.com/doi/abs/10.1080/00948705.2012.675071> (visited on 04/19/2019).

— (2017). *Games Are Not: The Difficult and Definitive Guide to What Video Games Are*. OCLC: 1004319796. Manchester: Manchester University Press. ISBN: 978-1-5261-2165-3.

Nacke, Lennart and Craig Lindley (Nov. 2008). "Flow and Immersion in First-Person Shooters: Measuring the Player's Gameplay Experience". In: *Proceedings of the 2008 Conference on Future Play: Research, Play, Share*. Toronto.

- Nagel, Thomas (1974). "What Is It like to Be a Bat?" In: *The philosophical review*, pp. 435–450. JSTOR: 2183914.
- Nakamura, Lisa (June 2009). "Don't Hate the Player, Hate the Game: The Racialization of Labor in World of Warcraft". In: *Critical Studies in Media Communication* 26.2, pp. 128–144. ISSN: 1529-5036, 1479-5809. DOI: 10.1080/15295030902860252. URL: <http://www.tandfonline.com/doi/abs/10.1080/15295030902860252> (visited on 09/22/2019).
- Nash, Adam and Thomas Penney (Oct. 2015). "The Radical Productivity of Play". In: *9th International Conference on the Philosophy of Computer Games*. 9th International Conference on the Philosophy of Computer Games. Berlin.
- Negri, Sara and Jan von Plato (2008). *Structural Proof Theory*. OCLC: 705650307. Cambridge: Cambridge Univ. Press. ISBN: 978-0-521-06842-0.
- Nicolelis, Miguel A. L. and Mikhail A. Lebedev (July 2009). "Principles of Neural Ensemble Physiology Underlying the Operation of Brain–Machine Interfaces". In: *Nature Reviews Neuroscience* 10.7, pp. 530–540. ISSN: 1471-003X, 1471-0048. DOI: 10.1038/nrn2653. URL: <http://www.nature.com/articles/nrn2653> (visited on 05/28/2019).
- Nietzsche, Friedrich Wilhelm (2008). *Twilight of the Idols, or, How to Philosophize with a Hammer*. Oxford World's Classics pbk. ed. (re-issued). Oxford World's Classics. Oxford: Oxford University Press [1889]. ISBN: 978-0-19-955496-6.
- Nieuwdorp, Eva (2005). "The Pervasive Interface; Tracing the Magic Circle". In: URL: <http://summit.sfu.ca/item/251> (visited on 09/09/2014).
- (Apr. 1, 2007). "The Pervasive Discourse: An Analysis". In: *Computers in Entertainment* 5.2, p. 13. ISSN: 15443574. DOI: 10.1145/1279540.1279553. URL: <http://portal.acm.org/citation.cfm?doid=1279540.1279553> (visited on 06/21/2019).
- Nijholt, Anton (2019). *Brain Art: Brain-Computer Interfaces for Artistic Expression*. OCLC: 1104917690. ISBN: 978-3-030-14323-7. URL: <https://doi.org/10.1007/978-3-030-14323-7> (visited on 08/15/2019).
- Noë, Alva (2010). *Out of Our Heads: Why You Are Not Your Brain, and Other Lessons from the Biology of Consciousness*. 1. paperback ed. OCLC: 699676071. New York: Hill and Wang. ISBN: 978-0-8090-1648-8.
- Norman, Donald A. (2007). *The Design of Future Things*. OCLC: 255921736. New York: Basic Books.
- Norton, Louise (May 1917). "The Richard Mutt Case". In: *The Blind Man* 2, pp. 5–6.

- Oakley, Todd H. and Daniel I. Speiser (Dec. 4, 2015). "How Complexity Originates: The Evolution of Animal Eyes". In: *Annual Review of Ecology, Evolution, and Systematics* 46.1, pp. 237–260. ISSN: 1543-592X, 1545-2069. DOI: 10.1146/annurev-ecolsys-110512-135907. URL: <http://www.annualreviews.org/doi/10.1146/annurev-ecolsys-110512-135907> (visited on 06/06/2016).
- Omsk Social Club (2019b). *Omsk Social Club FKA Punk Is Dada*. URL: <http://www.punkisdada.com> (visited on 09/06/2019).
- Ostrov, Jamie M. and EmilyJ Hart (2014). "Observational Methods". In: *The Oxford Handbook of Quantitative Methods, Volume 1* 1, p. 286.
- Ovidius Naso, Publius (2008). "Midas". In: *Metamorphoses*. Reissued. Oxford World's Classics. OCLC: 836866160. Oxford: Oxford Univ. Press, pp. 252–255. ISBN: 978-0-19-953737-2.
- Pagnutti, Johnathan, Kate Compton, and Jim Whitehead (2016). "Do You Like This Art I Made You: Introducing Techne, A Creative Artbot Commune". In: *Proceedings of 1st International Joint Conference of DiGRA and FDG*. URL: <http://45.55.28.224/wp-content/uploads/2016/07/techne-pcg-workshop-3.pdf> (visited on 03/10/2017).
- Panksepp, Jaak and Lucy Biven (2012). *The Archaeology of Mind: Neurorevolutionary Origins of Human Emotions*. 1. ed. The Norton Series on Interpersonal Neurobiology. OCLC: 812503591. New York: Norton. ISBN: 978-0-393-70531-7.
- Papert, Seymour and Idit Harel (1991). "Situating Constructionism". In: *Constructionism: Research Reports and Essays, 1985-1990*. Ed. by Massachusetts Institute of Technology. Norwood, N.J: Ablex Pub. Corp, pp. 1–18.
- Parsons, Talcott (2017). *Toward a General Theory of Action*. Andesite Press [1951].
- Patrick, George Thomas White (1916). *The Psychology of Relaxation*. In collab. with University of British Columbia Library. Boston and New York : Houghton Mifflin Co. URL: <http://archive.org/details/psychologyofrel00patr> (visited on 01/19/2015).
- Pedercini, Paolo (Feb. 14, 2014). *Videogames and the Spirit of Capitalism | Molleindustria*. URL: <http://www.molleindustria.org/blog/videogames-and-the-spirit-of-capitalism/> (visited on 04/23/2016).
- Peirce, Charles Sanders (Apr. 1905). "What Pragmatism Is". In: *The Monist* 15.2, pp. 161–181.
- Pelizzon, Alessandro and Monica Gagliano (Sept. 2015). "The Sentience of Plants: Animal Rights and Rights of Nature Intersecting?" In: *AAPLJ* 11, pp. 5–13.

- Pellegrini, Anthony D. (2009). *The Role of Play in Human Development*. New York: Oxford University Press. ISBN: 978-0-19-536732-4.
- Pellis, Sergio M., Vivien C. Pellis, and Heather C. Bell (2010). "The Function of Play in the Development of the Social Brain". In: *American Journal of Play* 2.3, pp. 278–298.
- Perotto, Filippo Studzinski (2013). "A Computational Constructivist Model as an Anticipatory Learning Mechanism for Coupled Agent–Environment Systems". In: *Constructivist Foundations* 9.1, pp. 46–56.
- Pezzani, Lorenzo (Nov. 8, 2018). "Hostile Environment(s)". Arge Kunst Public Programme (Bolzano). URL: <https://www.argekunst.it/en/2018/10/30/lorenzo-pezzani-hostile-environments/> (visited on 05/26/2019).
- Piaget, Jean (1952). *The Origins of Intelligence in Children*. International Universities Press.
- (1962). *Play, Dreams and Imitation in Childhood*. New York: Norton.
- Pickering, Andrew (1995). *The Mangle of Practice: Time, Agency, and Science*. Chicago: University of Chicago Press.
- (2011). *The Cybernetic Brain: Sketches of Another Future*. Paperback Ed. OCLC: 934870286. Chicago, Ill: University of Chicago Press. ISBN: 978-0-226-66790-4.
- Plato (1984). *Great Dialogues of Plato*. New York: Dutton Signet [–359]. ISBN: 978-0-451-52745-5.
- Popper, Karl R. (1989). *Conjectures and Refutations: The Growth of Scientific Knowledge*. 5th ed. (rev.) London ; New York: Routledge. ISBN: 978-0-415-04318-2.
- Possamai, Adam (2005). *Religion and Popular Culture: A Hyper-Real Testament*. Gods, Humans, and Religions no. 7. New York: P.I.E.-Peter Lang. ISBN: 978-90-5201-272-8.
- Prior, Andrew (Feb. 18, 2015). "Mediality Is Noise: The onto-Epistemology of Noise, Media Archaeology and Post-Digital Aesthetics". Aarhus Universitet, Institut for Kommunikation og Kultur - Medievidenskab.
- Prpa, Mirjana and Philippe Pasquier (2019). "Brain-Computer Interfaces in Contemporary Art: A State of the Art and Taxonomy". In: *Brain Art*. Ed. by Anton Nijholt. Cham: Springer International Publishing, pp. 65–115. DOI: 10.1007/978-3-030-14323-7_3. URL: http://link.springer.com/10.1007/978-3-030-14323-7_3 (visited on 09/16/2019).
- Przybylski, Andrew, Scott Rigby, and Richard Ryan (2010). "A Motivational Model of Video Game Engagement." In: *Review of General Psychology* 14.2, pp. 154–166. ISSN:

- 1939-1552, 1089-2680. DOI: 10.1037/a0019440. URL: <http://doi.apa.org/getdoi.cfm?doi=10.1037/a0019440> (visited on 01/09/2016).
- Raessens, Joost and Jeffrey H. Goldstein, eds. (2005). *Handbook of Computer Game Studies*. OCLC: ocm55518419. MIT Press. ISBN: 978-0-262-18240-9.
- Raessens, Jozef Frederik Ferdinand (2012). "Homo Ludens 2.0 The Ludic Turn in Media Theory". URL: <http://dspace.library.uu.nl/handle/1874/255181> (visited on 09/15/2015).
- Rafał, Modzelewski (2013). "Virtual Togetherness: Sense of Identity and Community in Cyberspace". In: *Crossroads. A Journal of English Studies* 1, pp. 37–53. ISSN: 23006250. DOI: 10.15290/cr.2013.01.03. URL: <http://repozytorium.uwb.edu.pl/jspui/handle/11320/755> (visited on 08/13/2019).
- Rahwan, lyad et al. (Apr. 2019). "Machine Behaviour". In: *Nature* 568.7753, pp. 477–486. ISSN: 0028-0836, 1476-4687. DOI: 10.1038/s41586-019-1138-y. URL: <http://www.nature.com/articles/s41586-019-1138-y> (visited on 09/18/2019).
- Ramadan, Zahy (Feb. 5, 2018). "The Gamification of Trust: The Case of China's "Social Credit"". In: *Marketing Intelligence & Planning* 36.1, pp. 93–107. ISSN: 0263-4503. DOI: 10.1108/MIP-06-2017-0100. URL: <http://www.emeraldinsight.com/doi/10.1108/MIP-06-2017-0100> (visited on 09/14/2019).
- Ramirez, Rafael and Zacharias Vamvakousis (2012). "Detecting Emotion from EEG Signals Using the Emotive Epoc Device". In: *Brain Informatics*. Ed. by Fabio Massimo Zanzotto et al. Vol. 7670. Berlin, Heidelberg: Springer Berlin Heidelberg, pp. 175–184. DOI: 10.1007/978-3-642-35139-6_17. URL: http://link.springer.com/10.1007/978-3-642-35139-6_17 (visited on 09/16/2019).
- Ramsey, Frank Plumpton (1927). "Facts and Propositions". In: *Proceedings of the Aristotelian Society* 7.1, pp. 153–170.
- Raskin, Jonathan D. (2002). "Constructivism in Psychology: Personal Construct Psychology, Radical Constructivism, and Social Constructionism". In: *Studies in Meaning: Exploring Constructivist Psychology*. Ed. by Jonathan D. Raskin and S. K. Bridges. New York: Pace University Press, pp. 1–25.
- Rauscher, Andreas et al. (2016). "Game Design for Urban Spaces". In: *PLAYIN THE CITY. Artistic and Scientific Approaches to Playful Urban Arts*. Navigationen - Zeitschrift Für Medien Und Kulturwissenschaften 16.1. Ed. by Andreas Rauscher, Judith Ackermann, and Daniel Stein. Panel Discussion, pp. 137–158. ISSN: 1619-1641. DOI: 10.13140/

RG.2.1.1606.8727. URL: <http://dokumentix.ub.uni-siegen.de/opus/volltexte/2016/1004/index.html>.

Reinhold, Annika Stefanie et al. (Sept. 13, 2019). "Behavioral and Neural Correlates of Hide-and-Seek in Rats". In: *Science* 365.6458, pp. 1180–1183. ISSN: 0036-8075, 1095-9203. DOI: 10.1126/science.aax4705. URL: <http://www.sciencemag.org/lookup/doi/10.1126/science.aax4705> (visited on 09/25/2019).

Rendell, Paul (July 2011). "A Universal Turing Machine in Conway's Game of Life". In: *2011 International Conference on High Performance Computing & Simulation. Simulation (HPCS)*. Istanbul, Turkey: IEEE, pp. 764–772. ISBN: 978-1-61284-380-3. DOI: 10.1109/HPCSim.2011.5999906. URL: <http://ieeexplore.ieee.org/document/5999906/> (visited on 09/05/2019).

Reynolds, Craig W. (1987). "Flocks, Herds and Schools: A Distributed Behavioral Model". In: *ACM Siggraph Computer Graphics* 21.4, pp. 25–34. URL: <http://dl.acm.org/citation.cfm?id=37406> (visited on 02/14/2015).

Reynolds, Richard (2009). *On Guerrilla Gardening: A Handbook for Gardening without Boundaries*. paperback ed. OCLC: 767949952. London: Bloomsbury. ISBN: 978-0-7475-9297-6.

Rheingold, Howard (1992). *Virtual Reality*. OCLC: 831987918. New York: Touchstone/Simon & Schuster.

Rigby, Scott and Richard Ryan (2007). *The Player Experience of Need Satisfaction*. Immersyve, Inc.

Riva, Giuseppe, Brenda K. Wiederhold, and Fabrizia Mantovani (Jan. 2019). "Neuroscience of Virtual Reality: From Virtual Exposure to Embodied Medicine". In: *Cyberpsychology, Behavior, and Social Networking* 22.1, pp. 82–96. ISSN: 2152-2715, 2152-2723. DOI: 10.1089/cyber.2017.29099.gri. URL: <https://www.liebertpub.com/doi/10.1089/cyber.2017.29099.gri> (visited on 09/25/2019).

Rogers, Shannon, Kevin Gardner, and Cynthia Carlson (Aug. 13, 2013). "Social Capital and Walkability as Social Aspects of Sustainability". In: *Sustainability* 5.8, pp. 3473–3483. ISSN: 2071-1050. DOI: 10.3390/su5083473. URL: <http://www.mdpi.com/2071-1050/5/8/3473/> (visited on 01/25/2015).

Rosenboom, David (Apr. 1970). "In Support of a Systems Theoretical Approach to Art Media". In: *Proceedings of the Fifth Annual Conference of the American Society of University Composers*. Hanover, New Hampshire, pp. 56–68.

- ed. (1976). *Biofeedback and the Arts, Results of Early Experiments*. 2d ed. Vancouver, B.C: Aesthetic Research Centre of Canada. ISBN: 978-0-88985-002-6.
- Ruberg, Bonnie and Adrienne Shaw, eds. (2017). *Queer Game Studies*. Minneapolis: University of Minnesota Press.
- Rubin, Edgar (1921). *Visuell Wahrgenommene Figuren: Studien in Psychologischer Analyse*. Kopenhagen: Gyldendal.
- Ruffino, Paolo (Aug. 2016). “Parasites to Gaming: Learning from GamerGate”. In: *Abstract Proceedings of the First International Joint Conference of DiGRA and FDG*. DiGRA/FDG.
- Russell, Bertrand (2015). *The Problems of Philosophy*. [1912]. ISBN: 978-1-5171-5945-0.
- Russell, Stuart J. and Peter Norvig (2010). *Artificial Intelligence: A Modern Approach*. 3rd ed. Prentice Hall Series in Artificial Intelligence. Upper Saddle River: Prentice Hall. ISBN: 978-0-13-604259-4.
- Salen, Katie and Eric Zimmerman (2003). *Rules of Play*. Cambridge, Mass.: MIT Press. ISBN: 0-262-24045-9.
- Salge, Christoph (Oct. 2012). “Information-Theoretic Models of Social Interaction”. Doctoral Thesis. University of Hertfordshire.
- Salthe, Stanley N (2003). *Development and Evolution. Complexity and Change in Biology*. Cambridge, Mass.: MIT Press. URL: <https://ezproxy.siastr.sk.ca:443/login?url=http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=e000xna&AN=1726> (visited on 09/06/2014).
- Samek, Wojciech and Klaus-Robert Muller (Aug. 2015). “Tackling Noise, Artifacts and Nonstationarity in BCI with Robust Divergences”. In: *2015 23rd European Signal Processing Conference (EUSIPCO)*. 2015 23rd European Signal Processing Conference (EUSIPCO). Nice: IEEE, pp. 2741–2745. ISBN: 978-0-9928626-3-3. DOI: 10.1109/EUSIPCO.2015.7362883. URL: <http://ieeexplore.ieee.org/document/7362883/> (visited on 05/28/2019).
- Samyn, Michaël (Mar. 19, 2010). *Not a Manifesto | Notgames Blog*. URL: <http://notgames.org/blog/2010/03/19/not-a-manifesto/> (visited on 09/24/2019).
- Sareen, Harpreet, Jiefu Zheng, and Pattie Maes (2019). “Cyborg Botany: Augmented Plants as Sensors, Displays and Actuators”. In: *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems - CHI EA '19*. Extended Abstracts of the 2019 CHI Conference. Glasgow, Scotland Uk: ACM Press, pp. 1–2.

- ISBN: 978-1-4503-5971-9. DOI: 10.1145/3290607.3311778. URL: <http://dl.acm.org/citation.cfm?doid=3290607.3311778> (visited on 06/22/2019).
- Sawyer, R. Keith (2003). *Group Creativity: Music, Theater, Collaboration*. Mahwah, N.J: L. Erlbaum Associates.
- Saygin, Ayse Pinar, Ilyas Cicekli, and Varol Akman (2003). "Turing Test: 50 Years Later". In: *The Turing Test*. Springer, pp. 23–78. URL: http://link.springer.com/chapter/10.1007/978-94-010-0105-2_2 (visited on 09/24/2015).
- Schechner, Richard (1998). "Playing". In: *Play & Culture* 1, pp. 3–19.
- Schell, Jesse (2015). *The Art of Game Design: A Book of Lenses*. Second edition. Boca Raton: CRC Press. ISBN: 978-1-4665-9864-5.
- Schiller, Friedrich von (1795). *Ueber Die Ästhetische Erziehung Des Menschen in Einer Reyhe von Briefen*. 1. Auflage. Die Horen. Tübingen: J. G. Cotta.
- Scholz, Trebor, ed. (2013). *Digital Labor: The Internet as Playground and Factory*. New York: Routledge.
- Schrank, Brian (Dec. 2010). "Play Beyond Flow: A Theory of Avant-garde Videogames". Atlanta, Georgia: Georgia Institute of Technology.
- (2014). *Avant-Garde Videogames: Playing with Technoculture*. In collab. with J. David Bolter. Cambridge, Mass.: The MIT Press. ISBN: 978-0-262-02714-4.
- Schredelseker, Klaus and Florian Hauser (2008). *Complexity and Artificial Markets*. Berlin: Springer. URL: <http://public.eblib.com/choice/publicfullrecord.aspx?p=367300> (visited on 09/06/2014).
- Schrum, Jacob, Igor V. Karpov, and Risto Miikkulainen (2012). "Humanlike Combat Behavior via Multiobjective Neuroevolution". In: URL: <http://nn.cs.utexas.edu/?schrum:believablebots12> (visited on 01/19/2015).
- Schulz von Thun, Friedemann (1981). *Miteinander Reden: Störungen Und Klärungen: Psychologie Der Zwischenmenschlichen Kommunikation*. Originalausg. Rororo Sachbuch. Reinbek bei Hamburg: Rowohlt. ISBN: 978-3-499-17489-6.
- Schuster, Uli (2012). *Encounter with the Berlin Police during Speed Gardening Guerrilla*. In collab. with Uli Schuster.
- Schwab, Michael (2011). *The Journal for Artistic Research (JAR)*. URL: <https://www.jar-online.net/> (visited on 06/10/2019).
- ed. (Jan. 14, 2014). *Experimental Systems: Future Knowledge in Artistic Research*. 1 edition. Leuven, Belgium: Leuven University Press. ISBN: 978-90-5867-973-4.

- Schwab, Michael and Henk Borgdorff, eds. (2014). *The Exposition of Artistic Research: Publishing Art in Academia*. Leiden: Leiden University Press. ISBN: 978-90-8728-164-9.
- Schwartz, David G (2007). *Roll the Bones: The History of Gambling*. OCLC: 676708170. New York: Gotham Books. ISBN: 978-1-59240-316-5.
- Schweighauser, Philipp (2009). "Doubly Real: Game Studies and Literary Anthropology; or, Why We Play Games". In: *eludamos* 3.2, pp. 115–132. URL: <https://www.eludamos.org/index.php/eludamos/article/view/vol3no2-1/122>.
- Searle, John R. (1980). "Minds, Brains, and Programs". In: *Behavioral and Brain Sciences* 3.3, pp. 417–457.
- (1995). *The Construction of Social Reality*. New York: Free Press. ISBN: 978-0-02-928045-4.
- Seiffert, Helmut and Gerard Radnitzky, eds. (1989). *Handlexikon Zur Wissenschaftstheorie*. München: Ehrenwirth. ISBN: 978-3-431-02616-0.
- Seneca, Lucius Annaeus (2004). *On the Shortness of Life*. Great Ideas 1. London: Penguin Books [49]. ISBN: 978-0-14-101881-2.
- Seyler, Axel (2013). *Wahrnehmen und Falschnehmen: Praxis der Gestaltpsychologie*. 4. Aufl. OCLC: 935104797. Frankfurt am Main: Anabas-Verl. ISBN: 978-3-87038-354-1.
- Shackell, Aileen et al. (2008). *Design for Play: A Guide to Creating Successful Play Spaces*. The Department for Children, Schools and Families (DCSF) and the Department for Culture, Media and Sport (DCMS). URL: <http://eprints.mdx.ac.uk/5028/1/design-for-play.pdf> (visited on 11/04/2016).
- Shannon, Claude E. (Mar. 1950). "Programming a Computer for Playing Chess". In: *Philosophical Magazine* 41.314, pp. 256–275. ISSN: 1941-5982, 1941-5990. DOI: 10.1080/14786445008521796. URL: <http://www.tandfonline.com/doi/abs/10.1080/14786445008521796> (visited on 09/19/2019).
- Sharman, Julien (1874). *The Proverbs of John Heywood. Being the "Proverbes" of That Author Printed 1546*. London: George Bell and Sons.
- Sharp, John (2015). *Works of Game: On the Aesthetics of Games and Art*. Playful Thinking. MIT Press. ISBN: 978-0-262-02907-0.
- Shaw, Adrienne (Oct. 2010). "What Is Video Game Culture? Cultural Studies and Game Studies". In: *Games and Culture* 5.4, pp. 403–424. ISSN: 1555-4120, 1555-4139. DOI: 10.1177/1555412009360414. URL: <http://journals.sagepub.com/doi/10.1177/1555412009360414> (visited on 03/04/2019).

- Sherman, Casey and Dave Wedge (2017). *The Ice Bucket Challenge: Pete Frates and the Fight against ALS*. OCLC: 1080884610. Lebanon, NH: ForeEdge. ISBN: 978-1-5126-0159-6.
- Sherry, John L. et al. (2006). "Video Game Uses and Gratifications as Predictors of Use and Game Preference". In: *Playing video games: Motives, responses, and consequences*, pp. 213–224. URL: http://www.researchgate.net/profile/John_Sherry/publication/259583577_Video_game_uses_and_gratifications_as_predictors_of_use_and_game_preference/links/54dc196b0cf28d3de65e9fed.pdf (visited on 01/09/2016).
- Shields, Rob (2003). *The Virtual*. Key Ideas. OCLC: ocm50410277. London ; New York: Routledge.
- Shin, Donghee (Jan. 2018). "Empathy and Embodied Experience in Virtual Environment: To What Extent Can Virtual Reality Stimulate Empathy and Embodied Experience?" In: *Computers in Human Behavior* 78, pp. 64–73. ISSN: 07475632. DOI: 10.1016/j.chb.2017.09.012. URL: <https://linkinghub.elsevier.com/retrieve/pii/S0747563217305381> (visited on 02/25/2019).
- Shin, Young-Chul et al. (Dec. 2015). "Gambling Disorder in Financial Markets: Clinical and Treatment-Related Features". In: *Journal of Behavioral Addictions* 4.4, pp. 244–249. ISSN: 2062-5871, 2063-5303. DOI: 10.1556/2006.4.2015.032. URL: <http://www.akademai.com/doi/abs/10.1556/2006.4.2015.032> (visited on 09/16/2019).
- Sicart, Miguel (2014). *Play Matters*. Playful Thinking. Cambridge, Mass.: The MIT Press. ISBN: 978-0-262-02792-2.
- Silver, David, Aja Huang, et al. (Jan. 27, 2016). "Mastering the Game of Go with Deep Neural Networks and Tree Search". In: *Nature* 529.7587, pp. 484–489. ISSN: 0028-0836, 1476-4687. DOI: 10.1038/nature16961. URL: <http://www.nature.com/doi/10.1038/nature16961> (visited on 01/30/2016).
- Silver, David, Thomas Hubert, et al. (Dec. 7, 2018). "A General Reinforcement Learning Algorithm That Masters Chess, Shogi, and Go through Self-Play". In: *Science* 362.6419, pp. 1140–1144. ISSN: 0036-8075, 1095-9203. DOI: 10.1126/science.aar6404. URL: <http://www.sciencemag.org/lookup/doi/10.1126/science.aar6404> (visited on 09/25/2019).

- Silver, David, Julian Schrittwieser, et al. (Oct. 18, 2017). "Mastering the Game of Go without Human Knowledge". In: *Nature* 550, p. 354. URL: <https://doi.org/10.1038/nature24270>.
- Simon, Fritz B., ed. (2009). *Vor dem Spiel ist nach dem Spiel: systemische Aspekte des Fußballs*. 1. Aufl. OCLC: 463785626. Heidelberg: Carl-Auer-Systeme Verl. ISBN: 978-3-89670-692-8.
- Simon, Herbert A. and William G. Chase (1988). "Skill in Chess". In: *Computer Chess Compendium*. Ed. by David Levy. Springer, pp. 2–13.
- Simons, Jan (2007). "Game Studies - Narrative, Games, and Theory". In: *Game Studies* 7.1. ISSN: 1604-7982. URL: <http://gamestudies.org/07010701/articles/simons> (visited on 05/15/2015).
- Sinker, Rebecca, Mike Phillips, and Victoria de Rijke (June 2017). "Playing in the Dark with Online Games for Girls". In: *Contemporary Issues in Early Childhood* 18.2, pp. 162–178. ISSN: 1463-9491, 1463-9491. DOI: 10.1177/1463949117714079. URL: <http://journals.sagepub.com/doi/10.1177/1463949117714079> (visited on 07/14/2019).
- Siviy, Stephen M. and Jaak Panksepp (Oct. 2011). "In Search of the Neurobiological Substrates for Social Playfulness in Mammalian Brains". In: *Neuroscience & Biobehavioral Reviews* 35.9, pp. 1821–1830. ISSN: 01497634. DOI: 10.1016/j.neubiorev.2011.03.006. URL: <http://linkinghub.elsevier.com/retrieve/pii/S0149763411000492> (visited on 09/01/2015).
- Slater, Mel (2003). "A Note on Presence Terminology". In: *Presence Connect* 3.3, pp. 1–5.
- Slavin, Kevin (2014). "Playful Systems". In: *The Gameful World: Approaches, Issues, Applications*. Ed. by Steffen P. Walz and Sebastian Deterding. Cambridge, Mass.: MIT Press, pp. 393–395. ISBN: 978-0-262-02800-4.
- Smith, Barry, ed. (1988). *Foundations of Gestalt Theory*. Philosophia Resources Library. München: Philosophia Verlag. ISBN: 978-3-88405-060-6.
- Smith, David Harris and Frauke Zeller (Oct. 4, 2016). "The Death and Lives of hitchBOT: The Design and Implementation of a Hitchhiking Robot". In: *Leonardo*. ISSN: 0024-094X, 1530-9282. DOI: 10.1162/LEON_a_01354. URL: http://www.mitpressjournals.org/doi/10.1162/LEON_a_01354 (visited on 10/26/2016).
- Snow, C. P. (1993). *The Two Cultures*. Canto Classics. London ; New York: Cambridge University Press [1963].

- Solomon R. Guggenheim Foundation (Sept. 21, 2017a). *Statement on the Video Work "Dogs That Cannot Touch Each Other"*. URL: <https://www.guggenheim.org/press-release/statement-on-the-video-work-dogs-that-cannot-touch-each-other> (visited on 07/23/2019).
- (Sept. 25, 2017b). *Statement Regarding Works in "Art and China after 1989: Theater of the World"*. URL: <https://www.guggenheim.org/press-release/works-in-art-and-china-after-1989-theater-of-the-world> (visited on 07/23/2019).
- Sommer, Laura Kim and Christian Andreas Klöckner (July 1, 2019). "Does Activist Art Have the Capacity to Raise Awareness in Audiences?—A Study on Climate Change Art at the ArtCOP21 Event in Paris." In: *Psychology of Aesthetics, Creativity, and the Arts*. ISSN: 1931-390X, 1931-3896. DOI: 10.1037/aca0000247. URL: <http://doi.apa.org/getdoi.cfm?doi=10.1037/aca0000247> (visited on 08/04/2019).
- Spariosu, Mihai (1989). *Dionysus Reborn: Play and the Aesthetic Dimension in Modern Philosophical and Scientific Discourse*. Ithaca, N.Y: Cornell University Press. ISBN: 0-8014-2327-9.
- Spencer, Herbert (1855). *The Principles of Psychology*. London: Longman, Brown, Green and Longmans.
- Spencer-Brown, George (2008). *Laws of Form*. Leipzig: Bohmeier [1969].
- Spielberg, Steven, director (2018). *Ready Player One*. IMDb ID: tt1677720. URL: <http://www.imdb.com/title/tt1677720/> (visited on 02/26/2019).
- Sprite Robotics (2015). *Petronics*. URL: <http://www.petronics.io/> (visited on 03/04/2015).
- Standage, Tom (2003). *The Turk: The Life and Times of the Famous Eighteenth-Century Chess-Playing Machine*. New York: Berkley. ISBN: 978-0-425-19039-5.
- Stanley, Kenneth O and Joel Lehman (2015). *Why Greatness Cannot Be Planned The Myth of the Objective*. OCLC: 1100898113. ISBN: 978-3-319-15524-1.
- Stavriniidou, Eleni et al. (Nov. 2015). "Electronic Plants". In: *Science Advances* 1.10, e1501136. ISSN: 2375-2548. DOI: 10.1126/sciadv.1501136. URL: <http://advances.sciencemag.org/lookup/doi/10.1126/sciadv.1501136> (visited on 06/23/2019).
- Stenros, Jaakko (2012). "In Defence of a Magic Circle: The Social and Mental Boundaries of Play". In: *Proceedings of 2012 DiGRA Nordic*, pp. 1–18. URL: <http://www.digra.org/dl/db/12168.43543.pdf> (visited on 09/05/2015).
- (2015). "Playfulness, Play, and Games - A Constructionist Ludology Approach". Tampere University.

- Stenros, Jaakko and Markus Montola, eds. (2010). *Nordic LARP*. 1st print. Stockholm: Fea Livia. ISBN: 978-91-633-7856-0.
- Stephenson, Neal (2011). *Snow crash*. London: Penguin [1992]. ISBN: 978-0-241-95318-1.
- Stevens, Reed, Tom Satwicz, and Laurie McCarthy (2008). "In-Game, In-Room, In-World: Reconnecting Video Game Play to the Rest of Kids' Lives". In: *The Ecology of Games: Connecting Youth, Games, and Learning*. Ed. by Katie Salen. Cambridge: The MIT Press, pp. 41–66.
- Stewart, Martyn (2012). "Understanding Learning: Theories and Critique". In: *University Teaching in Focus: A Learning-Centred Approach*. Ed. by L. Hunt and D. Chalmers. London: Routledge, pp. 3–20.
- Stott, Tim (2015). *Play and Participation in Contemporary Arts Practices*. Routledge Advances in Art and Visual Studies 12. OCLC: 896601668. New York, NY: Routledge.
- Straeubig, Michael (Nov. 2, 2013b). "Points, Fences, Distances, Grids, Fields or Bivariates? Models of Topological Representation for Location Based Games". Expanded Narrative Symposium (University of Plymouth).
- (Sept. 2014a). "Avant-Garde Videogames: Playing with Technoculture". In: *Leonardo Reviews*. ISSN: 1559-0429. URL: <http://leonardo.info/reviews/sep2014/technoculture.php> (visited on 05/11/2015).
- (Apr. 14, 2015a). "Can Machines Play?" Presentation Slides. Cognitive Futures in the Humanities (University of Oxford).
- (Jan. 19, 2015b). "Can Machines Play?" Presentation Slides. Digital Art and Technology Visiting Speakers (University of Plymouth).
- (Dec. 1, 2015c). "On the Distinction between Distinction and Division". In: *Technoetic Arts* 13.3, pp. 245–251. ISSN: 1477965X, 17589533. DOI: 10.1386/tear.13.3.245_1. URL: <http://openurl.ingenta.com/content/xref?genre=article&issn=1477-965X&volume=13&issue=3&page=245> (visited on 02/06/2016).
- (Nov. 1, 2016a). "Concept and Design of Playful Systems". Philosophy of Computer Games Conference. Doctoral Consortium. (University of Malta).
- (Apr. 25, 2016b). "Designing Playful Systems in Mixed Reality". Poster. CogNovo Workshop, The Neural Basis for Creativity (Plymouth). URL: https://www.researchgate.net/publication/303484754_Designing_Playful_Systems_in_Mixed_Reality?ev=prf_pub.

- (Nov. 2, 2016c). “Do Playful Systems Know That They Play?” Philosophy of Computer Games Conference (University of Malta).
 - (July 3, 2016d). “How to Perceive the Virtual Image? On the Distinction Between Virtual and Real”. Conference Presentation. Transimage (University of Plymouth).
 - (Apr. 23, 2016f). “Playing with Distinctions”. Presentation Slides. Researching Games Summit (Berlin).
 - (Aug. 1, 2016g). “Playing with Distinctions. Towards a Theory of Playful Systems”. DiGRA FDG 2016 Conference / Doctoral Consortium (University of Dundee).
 - (2016h). “The Virtual Other”. In: *AMAZE Magazine* 4.
 - (2016i). “The World beyond Our Senses. An Interview with Barney Steel and Ersin Han Ersin.” In: *AMAZE Magazine* 4. In collab. with Barney Steel and Ersin Han Ersin.
 - (May 20, 2016j). “Towards Play Design for Machines”. Presentation Slides. International Symposium on Electronic Art (Hong Kong City University).
 - (Apr. 21, 2017a). “Let the Machines out. Towards Hybrid Social Systems.” In: *Proceedings of AISB Annual Convention 2017*. Bath: Society for the Study of Artificial Intelligence and Simulation of Behaviour (AISB), pp. 28–31.
 - (Nov. 21, 2017b). “Playing with/as Systems: Short Paper, Discussion and Demonstration”. In: *AVANT. The Journal of the Philosophical-Interdisciplinary Vanguard* VIII (Special), pp. 197–203. ISSN: 20826710. DOI: 10.26913/80s02017.0111.0018. URL: <http://avant.edu.pl/en/issues/s2017/article18> (visited on 12/04/2017).
 - (2018b). *Hostile Environment Facility Training*.
 - (Jan. 2019). “Do Machines Produce Art? No. (A Systems-Theoretic Answer.)” In: Art Machines: International Symposium on Computational Media Art. Hong Kong City University.
 - (2020a). “Games, AI and Systems”. In: *eludamos. Journal for computer game culture* (Games and AI. Special Issue). [to appear]. ISSN: 1866-6124. URL: <http://www.eludamos.org/index.php/eludamos>.
 - (2020b). “The Communication Problem”. In: *Rivista Italiana di Filosofia del Linguaggio (RIFL)*.
- Straeubig, Michael, Chun-Wei Hsu, et al. (2016). “(How) Does Play Matter? A Transdisciplinary Approach to Play and Its Relation to Neurobiology, Creativity and Deception.” In: Off the Lip Conference - Transdisciplinary Approaches to Cognitive Innovation.

- Ed. by Michael Punt, Sue Denham, and Edith Doove. Plymouth, pp. 215–231. URL: <http://pearl.plymouth.ac.uk/handle/10026.1/4271> (visited on 02/21/2016).
- Straeubig, Michael and Sebastian Quack (2016). “Playful Locative Ensembles in the Urban Soundscape”. In: *PLAYIN THE CITY. Artistic and Scientific Approaches to Playful Urban Arts*. Navigationen - Zeitschrift Für Medien Und Kulturwissenschaften 16.1. Ed. by Judith Ackermann, Andreas Rauscher, and Daniel Stein, pp. 85–100. ISSN: 1619-1641. URL: <http://dokumentix.ub.uni-siegen.de/opus/volltexte/2016/1004/index.html>.
- Strawson, Peter F. (1950). “Truth”. In: *Proceedings of the Aristotelian Society Supplementary Volume XXIV*.
- Strogatz, Steven H (2014). *Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering*.
- Suarez, Daniel (2010). *Daemon*. OCLC: 836939134. London: Quercus. ISBN: 978-1-84724-961-6.
- (2011). *Freedom*. OCLC: 757404069. London: Quercus. ISBN: 978-0-85738-122-4.
- Suits, Bernard (Apr. 1967). “Is Life a Game We Are Playing?” In: *Ethics* 77.3, pp. 209–213. ISSN: 0014-1704, 1539-297X. DOI: 10.1086/291634. URL: <https://www.journals.uchicago.edu/doi/10.1086/291634> (visited on 04/19/2019).
- (1969). “Games and Paradox”. In: *Philosophy of Science* 36.3, pp. 316–321. ISSN: 00318248, 1539767X. JSTOR: 186226.
- (Jan. 1977). “Words On Play”. In: *Journal of the Philosophy of Sport* 4.1, pp. 117–131. ISSN: 0094-8705, 1543-2939. DOI: 10.1080/00948705.1977.10654132. URL: <http://www.tandfonline.com/doi/abs/10.1080/00948705.1977.10654132> (visited on 04/19/2019).
- (1978). *The Grasshopper Games, Life and Utopia*. OCLC: 757059168. Peterborough, Ont.: Broadview Press. ISBN: 978-1-55481-215-8. URL: <http://accesbib.uqam.ca/cgi-bin/bduqam/transit.pl?&noMan=25204654> (visited on 04/19/2019).
- Sutherland, Ivan E. (1968). “A Head-Mounted Three Dimensional Display”. In: *Proceedings of AFIPS*. San Francisco, California: ACM Press, pp. 757–764. DOI: 10.1145/1476589.1476686. URL: <http://portal.acm.org/citation.cfm?doid=1476589.1476686> (visited on 07/08/2019).

- Sutton, Richard S. and Andrew G. Barto (2018). *Reinforcement Learning: An Introduction*. 2nd ed. Adaptive Computation and Machine Learning. 2nd edition, to appear. Cambridge, Mass: MIT Press. ISBN: 978-0-262-19398-6.
- Sutton-Smith, Brian, ed. (1979). *Play and Learning*. Vol. 3. The Johnson and Johnson Pediatric Round Table. New York: Gardner Press. ISBN: 0-470-26509-4.
- (1997). *The Ambiguity of Play*. <http://site.ebrary.com/id/10326093>. Harvard University Press.
- (1999). “Evolving a Consilience of Play Definitions: Playfully”. In: *Play Contexts Revisited*. Play & Culture Studies 2. OCLC: 247296149. Stamford, Conn: Ablex Publ, pp. 239–256.
- Swink, Steve (2009). *Game Feel: A Game Designer’s Guide to Virtual Sensation*. Amsterdam ; Boston: Morgan Kaufmann Publishers/Elsevier. ISBN: 978-0-12-374328-2.
- Szulborski, Dave (2005). *This Is Not a Game: A Guide to Alternate Reality Gaming*. OCLC: 698942318. S.I.: New-Fiction Publ. ISBN: 978-1-4116-2595-2.
- Taiz, Lincoln et al. (July 2019). “Plants Neither Possess nor Require Consciousness”. In: *Trends in Plant Science*, S1360138519301268. ISSN: 13601385. DOI: 10.1016/j.tplants.2019.05.008. URL: <https://linkinghub.elsevier.com/retrieve/pii/S1360138519301268> (visited on 07/03/2019).
- Tanghe, Koen B. (Oct. 19, 2016). “Homo Ludens (1938) and the Crisis in the Humanities”. In: *Cogent Arts & Humanities* 3.1. ISSN: 2331-1983. DOI: 10.1080/23311983.2016.1245087. URL: <https://www.cogentoa.com/article/10.1080/23311983.2016.1245087> (visited on 09/23/2019).
- Tarski, Alfred (1944). “The Semantic Conception of Truth and the Foundation of Semantics”. In: *Philosophy and Phenomenological Research* 4. URL: <http://www.ditext.com/tarski/tarski.html>.
- Taylor, Russell (June 11, 2018). *Impact of ‘Hostile Environment’ Policy*. UK House of Lords.
- The International Football Association Board (2018). *Laws of the Game*.
- Thompson, Don (2010). *12 Million Dollar Stuffed Shark: The Curious Economics of Contemporary Art*. OCLC: 782863928. London: Aurum Press. ISBN: 978-1-84513-651-2. URL: <https://www.overdrive.com/search?q=0263BADD-7DFF-487C-A55B-8665BB4C9F28> (visited on 12/17/2018).
- Tinbergen, Niko (1963). “On Aims and Methods of Ethology”. In: *Zeitschrift für Tierpsychologie* 20.4, pp. 410–433.

- Tosney, Nicholas (Apr. 2008). "Gaming in England, c. 1540-1760". Doctoral Thesis. York: University of York.
- Turing, Alan (1950). "Computing Machinery and Intelligence". In: *Mind*, pp. 433–460. JSTOR: 2251299.
- (May 15, 1951). *Can Digital Computers Think?* URL: <http://www.turingarchive.org/browse.php/B/5>.
- U.S. DOE (2008). *Carbon Cycling and Biosequestration: Integrating Biology and Climate Through Systems Science*. DOE/SC-108. U.S. Department of Energy Office of Science.
- Upravitelev, Max, ed. (2014). *Front Deutscher Äpfel: das Buch zur Bewegung*. 1. Aufl. OCLC: 899749580. Hildesheim: Fruehwerk. ISBN: 978-3-941295-13-1.
- Vanderstraeten, Raf (2001). "Observing Systems: A Cybernetic Perspective on System/Environment Relations". In: *Journal for the theory of social behaviour* 31.3, pp. 297–311. URL: <http://ift-malta.com/wp-content/uploads/2013/04/Cybernetics-Paper.pdf> (visited on 04/18/2017).
- Van Eck, Wim and Maarten H. Lamers (2018). "Mapping the Field of Organism-Involved Computer Games". In: *Proceedings of the 13th International Conference on the Foundations of Digital Games - FDG '18*. The 13th International Conference. Malmö, Sweden: ACM Press, pp. 1–8. ISBN: 978-1-4503-6571-0. DOI: 10.1145/3235765.3235784. URL: <http://dl.acm.org/citation.cfm?doid=3235765.3235784> (visited on 06/24/2019).
- Van Loon, Austin et al. (Aug. 30, 2018). "Virtual Reality Perspective-Taking Increases Cognitive Empathy for Specific Others". In: *PLOS ONE* 13.8. Ed. by Claus Lamm, e0202442. ISSN: 1932-6203. DOI: 10.1371/journal.pone.0202442. URL: <http://dx.plos.org/10.1371/journal.pone.0202442> (visited on 02/25/2019).
- Varela, Francisco J., Humberto R. Maturana, and R. Uribe (May 1974). "Autopoiesis: The Organization of Living Systems, Its Characterization and a Model." In: 5.4, pp. 187–196.
- Vella, Daniel (Feb. 2015). "The Ludic Subject and the Ludic Self: Analyzing the 'I-in-the-Gameworld'". Doctoral Thesis. Copenhagen: IT University of Copenhagen.
- (2016). "'Who Am I' in the Game?": A Typology of the Modes of Ludic Subjectivity". In: *Proceedings for the First International Joint Conference of DiGRA and FDG*. DiGRA FDG 2016 Conference / Doctoral Consortium. Dundee. DOI: 10.13140/RG.2.1.4057.4322.

- Vilmer, Jean-Baptiste Jeangène (2009). "Animaux dans l'art contemporain: la question éthique". In: *Jeu : revue de théâtre*, n° 130, (1) 2009, p. 40-47. 130, pp. 40–47.
- Vinyals, Oriol et al. (2019). *AlphaStar: Mastering the Real-Time Strategy Game StarCraft II*. URL: <https://deepmind.com/blog/alphastar-mastering-real-time-strategy-game-starcraft-ii/>.
- Von Foerster, Heinz (1973). "On Constructing a Reality." In: *Environmental Design Research*. Red. by Wolfgang F. E. Preiser. Vol. 2. Stroudsburg: Dowden, Hutchinson & Ross, pp. 35–46. URL: <http://www.univie.ac.at/constructivism/hvf/072>.
- ed. (1995). *Cybernetics of Cybernetics: The Control of Control and the Communication of Communication*. 2. ed. The Cybertician 8. Minneapolis, Minn: Future Systems [1973].
- (2003). "On Constructing a Reality". In: *Understanding Understanding: Essays on Cybernetics and Cognition*. New York: Springer [1973], pp. 211–227. ISBN: 0-387-95392-2.
- Von Glasersfeld, Ernst (1992). "Questions and Answers about Radical Constructivism". In: vol. Vol. II: Relevant research. Washington, D.C.: The National Science Teachers Association, pp. 169–182.
- (2005). "Thirty Years Radical Constructivism". In: *Constructivist Foundations* 1.1.
- Von Trier, Lars, director (2003). *Dogville*.
- Waern, Annika (Sept. 13, 2011). "'I'm in Love with Someone That Doesn't Exist!' Bleed in the Context of a Computer Game". In: *Journal of Gaming & Virtual Worlds* 3.3, pp. 239–257. ISSN: 1757-191X. DOI: 10.1386/jgvw.3.3.239_1. URL: http://www.ingentaconnect.com/content/10.1386/jgvw.3.3.239_1 (visited on 09/09/2019).
- Walz, Steffen P. (2010). *Toward a Ludic Architecture: The Space of Play and Games*. OCLC: 934438730. Pittsburgh, PA: ETC Press. ISBN: 978-0-557-28563-1.
- Warburton, Nigel (2003). *The Art Question*. London ; New York: Routledge. ISBN: 0-415-17489-9.
- Warwitz, Siegbert A. and Anita Rudolf (2016). *Vom Sinn des Spielens: Reflexionen und Spielideen*. 4. aktualisierte Auflage. OCLC: 958469460. Baltmannsweiler: Schneider Verlag Hohengehren. ISBN: 978-3-8340-1664-5.
- Watzlawick, Paul (2011). *The Invented Reality: How Do We Know What We Believe We Know?* OCLC: 756900074. W.W. Norton & Co. ISBN: 978-0-393-33347-3.

- Watzlawick, Paul, Janet Beavin Bavelas, and Don D. Jackson (2014). *Pragmatics of Human Communication: A Study of Interactional Patterns, Pathologies, and Paradoxes*. First published as a Norton paperback 2011, reissued 2014. New York: W. W. Norton & Company. ISBN: 978-0-393-71059-5.
- Weisberg, Deena Skolnick, Jordan C V Taylor, and Emily J Hopkins (2015). “Deconstructing the Seductive Allure of Neuroscience Explanations”. In: *Judgment and Decision Making* 10.5, p. 13.
- Wells, A. J. (July 2002). “Gibson’s Affordances and Turing’s Theory of Computation”. In: *Ecological Psychology* 14.3, pp. 140–180. ISSN: 1040-7413, 1532-6969. DOI: 10.1207/S15326969EC01403_3. URL: http://www.tandfonline.com/doi/abs/10.1207/S15326969EC01403_3 (visited on 10/13/2014).
- Welsch, Wolfgang (2000). “Virtual to Begin With?” In: *Subjektivität Und Öffentlichkeit - Kulturwissenschaftliche Grundlagenprobleme Virtueller Welten*. Ed. by Mike Sandbothe and Winfried Marotzki. Köln: Herbert von Halem Verlag, pp. 25–60. URL: <http://www2.uni-jena.de/welsch/Papers/VirtualTBW.html> (visited on 07/25/2014).
- Werbach, Kevin and Dan Hunter (2012). *For the Win: How Game Thinking Can Revolutionize Your Business*. OCLC: 911049737. Philadelphia: Wharton Digital Press.
- Westerlaken, Michelle (2016). “Playful Animals: An Invitation to Participate”. In: *Proceedings of 1st International Joint Conference of DiGRA and FDG*. Dundee.
- (May 2017). “Uncivilising the Future: Imagining Non-Speciesism”. In: *antae* 4.1, pp. 53–67.
- Wetzel, Richard, Lisa Blum, and Leif Oppermann (2012). “Tidy City: A Location-Based Game Supported by In-Situ and Web-Based Authoring Tools to Enable User-Created Content”. In: *Proceedings of the International Conference on the Foundations of Digital Games*. FDG ’12. New York, NY, USA: ACM, pp. 238–241. ISBN: 978-1-4503-1333-9. DOI: 10.1145/2282338.2282385. URL: <http://doi.acm.org/10.1145/2282338.2282385> (visited on 05/02/2014).
- White, R. W. (1959). “Motivation Reconsidered: The Concept of Competence”. In: *Psychological Review* 66.5, pp. 297–333.
- Whitmyer, Claude, ed. (1994). *Mindfulness and Meaningful Work: Explorations in Right Livelihood*. Berkeley, Calif: Parallax Press. ISBN: 978-0-938077-54-1.

- Wiener, Norbert (2007). *Cybernetics or Control and Communication in the Animal and the Machine*. 2. ed., 14. print. Cambridge, Mass: MIT Press [1948]. ISBN: 978-0-262-73009-9.
- Wiener, Oswald (1990). *Probleme Der Künstlichen Intelligenz*. Perspektiven Der Technikokultur 158. Berlin: Merve. ISBN: 978-3-88396-078-4.
- Wilcox, John (June 1953). "The Beginnings of l'Art Pour l'Art". In: *The Journal of Aesthetics and Art Criticism* 11.4, p. 360. ISSN: 00218529. DOI: 10.2307/426457. URL: <https://www.jstor.org/stable/426457?origin=crossref> (visited on 09/10/2019).
- Wilson, Peter Lamborn and Bill Weinberg, eds. (1999). *Avant Gardening: Ecological Struggle in the City and the World*. OCLC: 254840920. Brooklyn, NY: Autonomedia. ISBN: 978-1-57027-092-5.
- Winnicott, Donald W. (2010). *Playing and Reality*. Reprint. Routledge Classics. OCLC: 844786558. London: Routledge. ISBN: 978-0-415-34546-0.
- Wittgenstein, Ludwig (1958). *Philosophical Investigations*. 2nd ed. Oxford: Basil Blackwell.
- (2007). *Tractatus Logico-Philosophicus*. New York, NY: Cosimo Classics [1922]. ISBN: 978-1-60206-451-5.
- Wohlleben, Peter (2016). *The Hidden Life of Trees: What They Feel, How They Communicate: Discoveries from a Secret World*. OCLC: 1017127779. Greystone Books. ISBN: 978-1-77164-248-4.
- Wolfram, Stephen (2002). *A New Kind of Science*. Champaign, IL: Wolfram Media. ISBN: 978-1-57955-008-0.
- Wolpaw, J.R. et al. (June 2000). "Brain-Computer Interface Technology: A Review of the First International Meeting". In: *IEEE Transactions on Rehabilitation Engineering* 8.2, pp. 164–173. ISSN: 1063-6528. DOI: 10.1109/TRE.2000.847807. URL: <http://ieeexplore.ieee.org/document/847807/> (visited on 05/28/2019).
- Woolgar, Steve (1985). "Why Not a Sociology of Machines? The Case of Sociology and Artificial Intelligence". In: *Sociology* 19.4, pp. 557–572. ISSN: 00380385, 14698684. JSTOR: 42853468.
- Woolley, Benjamin (1993). *Virtual Worlds: A Journey in Hype and Hyperreality*. OCLC: 832157444. London: Penguin. ISBN: 978-0-14-015439-9.
- Wright, Ben, director (Aug. 20, 2012). *Slavoj Žižek: The Reality of the Virtual*. URL: <https://www.youtube.com/watch?v=RnTQhIRcrno> (visited on 08/17/2019).

- Wulf, Christoph, ed. (1973). *Friedenserziehung in Der Diskussion*. Serie Piper 64. OCLC: ocm17664077. München: R. Piper. ISBN: 978-3-492-00364-3.
- Yang, Robert (Dec. 5, 2016). *A Progressive Future for VR: Why VR Is Already Getting Worse, and How to Make It Better*. URL: <https://www.blog.radiator.debaacle.us/2016/12/a-progressive-future-for-vr-why-vr-is.html> (visited on 02/26/2019).
- Yannakakis, Georgios N. and Julian Togelius (2018). *Artificial Intelligence and Games*. Springer.
- Yetisen, Ali K. et al. (Dec. 2015). "Bioart". In: *Trends in Biotechnology* 33.12, pp. 724–734. ISSN: 01677799. DOI: 10.1016/j.tibtech.2015.09.011. URL: <https://linkinghub.elsevier.com/retrieve/pii/S016777991500205X> (visited on 06/23/2019).
- Young, Michael Dunlop (1994). *The Rise of the Meritocracy*. New Brunswick, N.J., U.S.A: Transaction Publishers. ISBN: 978-1-56000-704-3.
- Zaborowski, Rafal (Mar. 1, 2016). "Hatsune Miku and Japanese Virtual Idols". In: *The Oxford Handbook of Music and Virtuality*. Ed. by Sheila Whiteley and Shara Rambarran. The Oxford Handbook Series. Oxford University Press, pp. 111–128. DOI: 10.1093/oxfordhb/9780199321285.013.7. URL: <http://oxfordhandbooks.com/view/10.1093/oxfordhb/9780199321285.001.0001/oxfordhb-9780199321285-e-7> (visited on 08/17/2019).
- Zimmerman, Eric (2009). "Gaming Literacy: Game Design as a Model for Literacy in the Twenty-First Century". In: *The video game theory reader 2*, pp. 23–31. URL: <http://www.neliufpe.com.br/wp-content/uploads/2014/02/08.pdf> (visited on 09/26/2014).
- (2011). *Interview with Eric Zimmerman, Game Designer*. In collab. with Eric Zimmerman and Naomi Clark. URL: <https://submarinechannel.com/profiles/profile-eric-zimmerman/>.
- (Feb. 7, 2012). "Jerked Around by the Magic Circle - Clearing the Air Ten Years Later". In: *Gamasutra*. URL: https://www.gamasutra.com/view/feature/135063/jerked_around_by_the_magic_circle_.php (visited on 09/07/2019).
- (Sept. 10, 2014a). *Games, Stay Away from Art. Please*. URL: <http://www.polygon.com/2014/9/10/6101639/games-art> (visited on 04/20/2016).
- (2014b). "Manifesto for a Ludic Century". In: *The Gameful World: Approaches, Issues, Applications*. Ed. by Sebastian Deterding and Steffen P. Walz. Cambridge, Mass.: MIT Press, pp. 19–22. ISBN: 978-0-262-02800-4.

Žižek, Slavoj (2012). *Organs without Bodies: On Deleuze and Consequences*. Routledge Classics. New York: Routledge.

Zook, Alexander, Brian Magerko, and Mark Riedl (2011). "Formally Modeling Pretend Object Play". In: *Proceedings of the 8th ACM Conference on Creativity and Cognition*. ACM, pp. 147–156. URL: <http://dl.acm.org/citation.cfm?id=2069644> (visited on 12/10/2014).

List of publications produced during period of study:

Straeubig, M. (2015) 'On the distinction between distinction and division', *Technoetic Arts*, 13(3), pp. 245–251. doi: 10.1386/tear.13.3.245_1.

Straeubig, M. and Quack, S. (2016) 'Playful Locative Ensembles in the Urban Soundscape', *PLAYIN THE CITY. Artistic and Scientific Approaches to Playful Urban Arts*. Edited by J. Ackermann, A. Rauscher, and D. Stein. (*Navigationen - Zeitschrift für Medien und Kulturwissenschaften*), 16(1), pp. 85–100.

Straeubig, M. (2017) 'Playing with/as Systems: Short Paper, Discussion and Demonstration', *AVANT. The Journal of the Philosophical-Interdisciplinary Vanguard*, VIII(Special), pp. 197–203. doi: 10.26913/80s02017.0111.0018.